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DEVOTED TO THE IMPROVEMENT OF CITIES.

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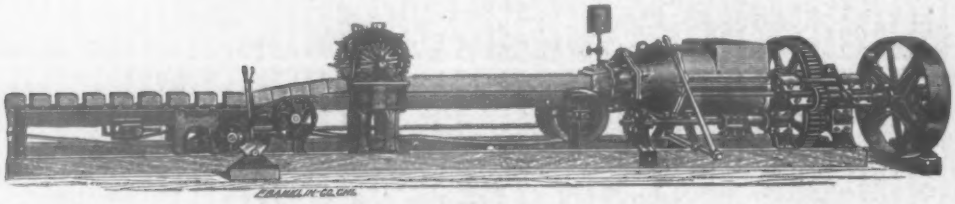

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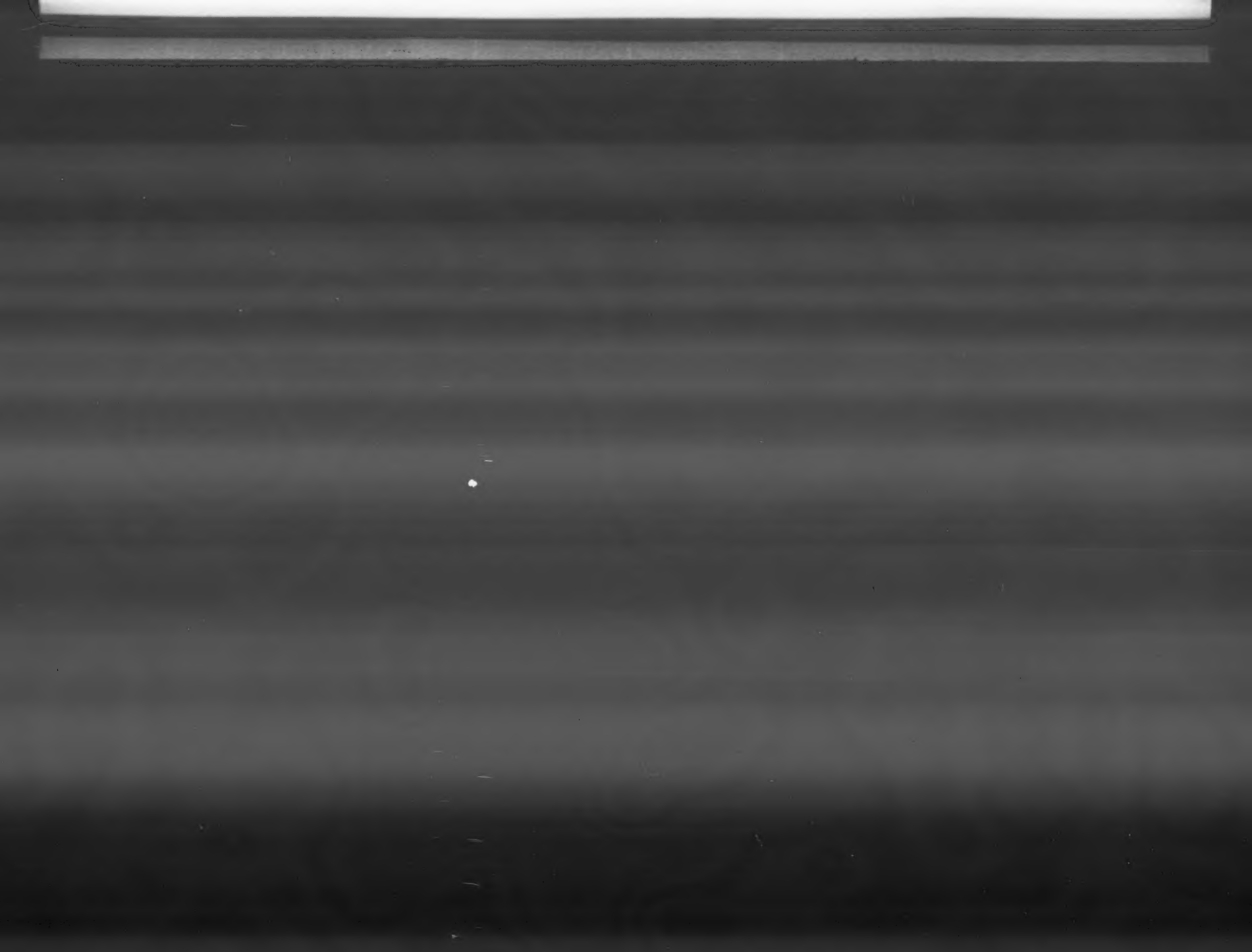


Paving and Municipal Engineering

VOLUME IX. OCTOBER, EIGHTEEN NINETY-FIVE. NUMBER 4.

PUBLIC WORK DISCUSSED BY MUNICIPAL OFFICERS.

A GENERAL OUTLINE OF THE MORE NOTABLE FEATURES OF THE SECOND ANNUAL MEETING OF THE AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS, FOLLOWED BY PAPERS AND DISCUSSIONS.

THE people of Cincinnati proved admirable entertainers for the American Society of Municipal Improvements, which held its second annual meeting there on September 11th, 12th and 13th. The local committee of arrangements, composed of the city officials of Cincinnati, with Mr. Aug. Herrmann, President of the Board of Administration, as chairman, neglected nothing within their power which would contribute to the success or enjoyment of the meeting. They were indefatigable in their efforts as entertainers, and they represented the hospitality of their city in a way both lavish and gracious. Carriage drives over good pavements to points showing the best achievement of the city in municipal engineering, through parks where nature and skill present some of the most beautiful glimpses of scenery to be found in America, over roads winding up and down heights of unsurpassed grandeur, along with street-car rides to suburban points and up and down those famous incline planes, as well as to many notable points of interest, such as the art gallery, the zoological garden, and some of the great industrial establishments, a grand fire-works display for the special entertainment of the visitors, an exhibition of skill by the fire and police departments, with the serving of refreshments at every turn, and closing with an elaborate banquet—these were some of the many courtesies which will make the visit to Cincinnati probably the most memorable in the yet young history of the American Society of Municipal Improvements, for it is not likely

and is not to be expected that any city will attempt to entertain this organization as Cincinnati did last month.

The attendance at the meeting was much larger than at Buffalo a year ago. About twenty cities were represented at Buffalo and about seventy at Cincinnati. The efforts of the Cincinnati committee of arrangements in arousing interest in the meeting were largely the cause of the increased attendance. The arrangement of a program for the sessions of the organization was not given the attention by the executive committee of the society that is very properly promised for the future. Two or three hours a day were devoted to business; the rest of the time was pleasantly occupied with the entertainment provided by the Cincinnati people.

In welcoming the society to Cincinnati, Mayor Caldwell referred to the many commercial advantages of the city, its development in art and music and its educational institutions. He spoke of the large possibilities of the society in broadening and fostering municipal government in its various branches.

Vice-President Benzenberg, responding on behalf of the society, said in the course of his remarks: "Our society is on the threshhold of a great and useful future. When it first met, one year ago, there were present only the representatives of thirteen cities, and it was very doubtful what its future would be. We are meeting today with a representation of seventy cities and 250 delegates. They are the men whom the people have intrusted with the great public works in which every year more than $100,000,000 is expended. The object of our society is to promote their efficiency by gaining from the knowledge and experience of others and by enlightening them that they may be able to avoid the dangers, risks and errors into which so many have fallen and which have resulted in loss and detriment to the cities. It is to be noted that so many of the younger cities are alive to these facts. Instead of blundering along in the old way at great cost to themselves they are sending their delegates here to learn what is best and newest and successful in public works, and they will build their future on the knowledge so obtained. This means, in the first place, economy; public works will be built in the most economical manner and in the best manner for the health, comfort and enjoyment of the people. It is for this we shall labor here."

A new and more complete constitution was adopted, the discussion of which occupied much of the time during the first two days. It restricts the membership absolutely to municipal representation, embracing only officials and engineers employed on municipal work. Members who have ceased to be city officials shall become associate members, with all the privileges of regular members, except that they shall neither vote nor hold office. The membership fee was left at $5, and the annual dues were fixed at $3.

LAKE SCENE, BURNET WOODS PARK, CINCINNATI.

The new constitution authorized the appointment of standing committees on street paving, electric lighting, sewers and sanitation, water-works, taxation and assessment, city government and legislation, garbage and street cleaning, each to consist of three members, and it will be their duty to submit reports to the annual meetings on the subjects assigned to them, as well as to arrange for the preparation of papers and discussions. The serious work of the organization is expected to proceed from these committees. The president appointed as the members of these committees for the next year the following named persons:

Street Paving—A. D. Thompson, Peoria, Ill.; Nelson P. Lewis, Brooklyn, N. Y.; S. J. Hathaway, Marietta, O.

Electric Lighting—J. A. Cabot, Cincinnati; Harold P. Brown, Newark, N. J.; F. W. Cappellen, Minneapolis, Minn.

Sewers—R. E. McMath, St. Louis; G. L. Clausen, Newark; Geo. N. Fernald, Portland, Me.

Water-Works—H. Van Duyne, Newark; E. H. Keating, Toronto; S. J. Hathaway, New Bedford, Mass.

Tax Assessment—G. F. Munro, Omaha, Neb.; Thomas De Vilbiss, Ft. Wayne, Ind.; Charles P. Sayres.

City Government and Legislation—D. E. Wright, Cleveland; C. C. Brown, Indianapolis; J. M. McConkey, Harrisburg, Pa.

Garbage and Street Cleaning—J. S. O'Shea, Buffalo; Lyman H. Johnson, New Haven; Dr. Prendergast, Cincinnati.

Finance Committee—L. W. Rundlett, St. Paul, Minn.; F. J. O'Brien, Oswego, N. Y.; W. H. Glover, Covington, Ky.

The sessions of the society were presided over by Mr. G. H. Benzenberg, the first vice-president, in the absence of President Murphy, who sent a letter stating that as he had retired from the position of street commissioner of St. Louis he felt that he was no longer in position to act as an officer of the society. As an evidence of the appreciation of the efforts of Mr. Murphy in starting the movement which had resulted in the organization of the society, no action was taken on his letter, which was intended as a resignation. In the talk about officers for the next year three men were frequently mentioned for the presidency: Mr. Benzenberg, whom many thought deserved promotion; Mr. Aug. Herrmann, of Cincinnati, and Mr. W. R. Kerr, of Chicago. A nominating committee was appointed, consisting of Mr. Wright, of Cleveland; Mr. States, of Connecticut; Mr. Jackson, of Chicago; Mr. Munro, of Omaha, and Mr. Hathaway, of Massachusetts. In their report they recommended Mr. Kerr, of Chicago, for first vice-president, and Mr. Herrmann, of Cincinnati, for second vice-president. The positions were changed on a motion by Mr. Kerr, after a suggestion by Dr. Prendergast, and the officers for the next year were unanimously elected as follows:

President—G. H. Benzenberg, President of the Board of Public Works of Milwaukee.

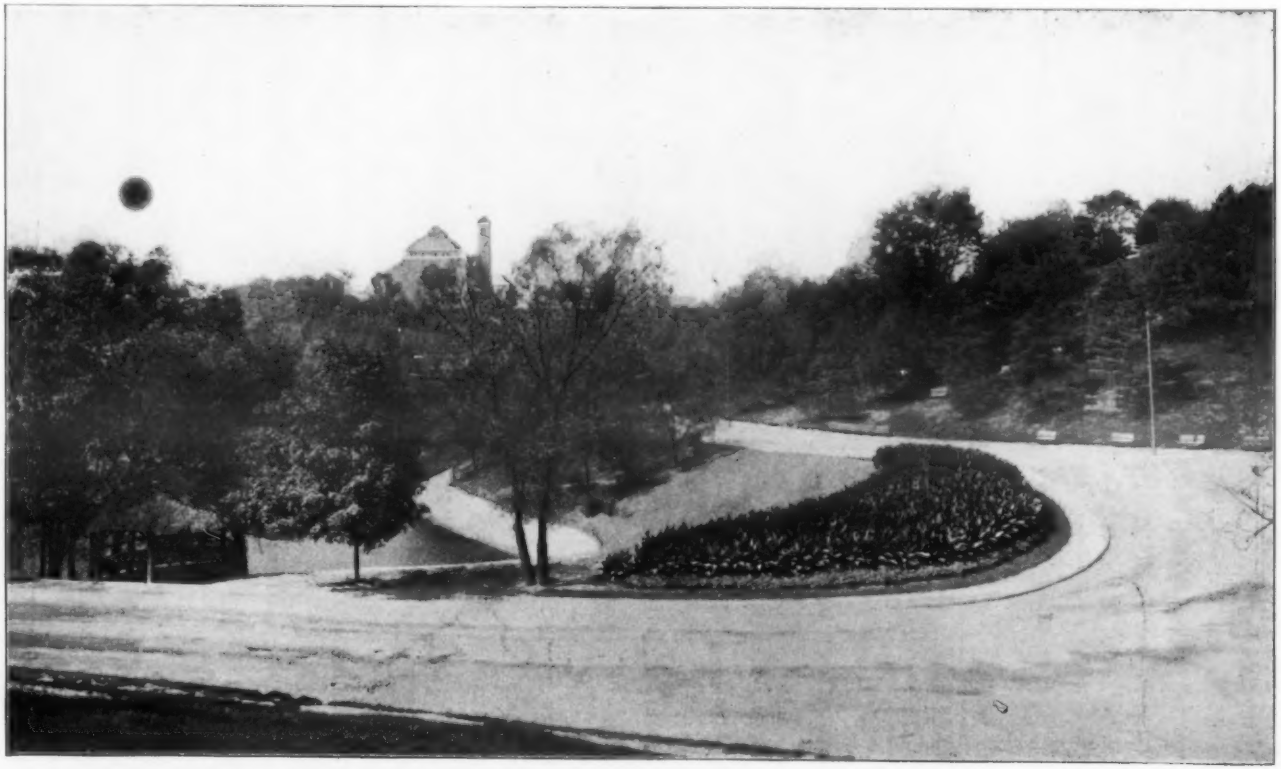
First Vice-President—August Herrmann, President of the Board of Administration of Cincinnati.

Second Vice-President—William R.Kerr, Commissioner of Health of Chicago.

Third Vice-President—James E. McGann, Member of the Board of Public Works of New Haven.

Secretary—David L. Fulton, Superintendent of Highways and Sewers of Allegheny City.

Treasurer—John L. Kennedy, Board of Public Works of Nashville.



A SCENE IN EDEN PARK, CINCINNATI.

The committee on nominations reported invitations from Chicago, Indianapolis and Nashville as meeting places for the society next year. Addresses were heard from Mr. Patten, representing Chicago; Mr. Fortune, on behalf of Indianapolis, and Mr. Kennedy, for Nashville. The invitation from Chicago was accepted, and the next meeting will be held there in October, 1896.

Resolutions were adopted expressing appreciation of the complete arrangements and the delightful entertainment provided by the Cincinnati people through their executive committee, composed of Aug. Herrmann, chairman; A. P. Butterfield, secretary; John B. Washburn, John Frey and Geo. T. Sterritt, of the board of administration; R. H. Wardee, superintendent of parks; Willis P. Tharp, superintendent of water-works; H. J. Stanley, city engineer; Dr. J. W. Prendergast, health officer; J. A. Cabot, city electrician; Fred Amthauer, superintendent of street cleaning; Edward Bogen, superintendent of city infirmary, and Elliott Marfield, purchasing agent.

The complimentary banquet, at the Gibson House, at the close of the meeting, was attended by over two hundred persons. It was all that unstinted hospitality could make it—an elaborate and delectable menu, artistic souvenirs, beautiful decorations, good music—a splendid climax to three days of continuous entertainment of the most generous kind.

The papers and discussions follow this general outline of the meeting.

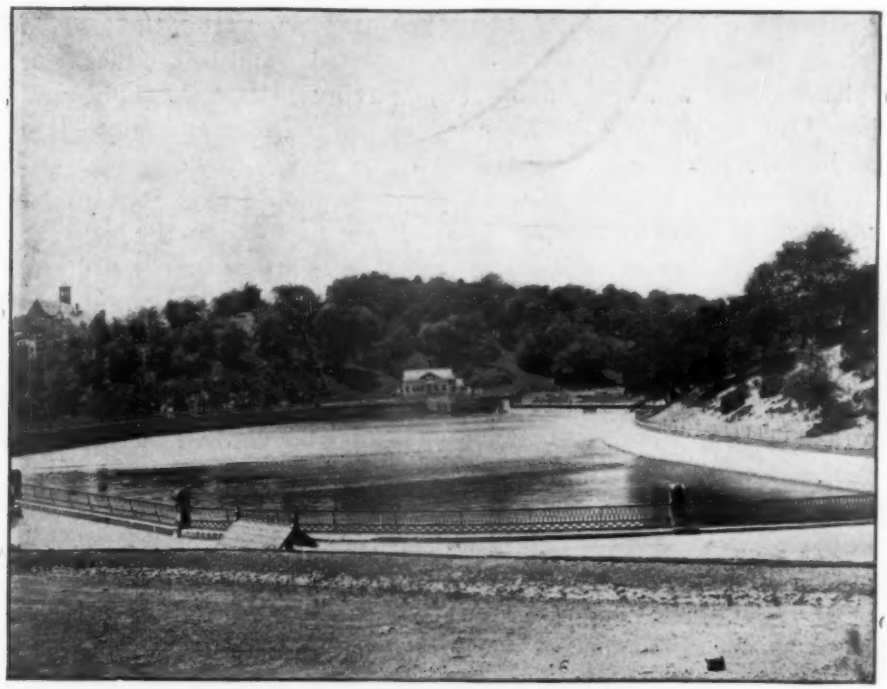
DIFFERENCES IN SPECIFICATIONS FOR VITRIFIED PAVING BRICK.

By W. G. Wilkins, C. E.

THE writer, shortly after taking charge of the Bureau of Engineering and Surveys of the city of Allegheny, Pa., was called upon to prepare specifications for vitrified brick pavements. This being something in which he had had no previous experience, he naturally concluded that it would be well to look up and study the specifications of other cities which had used this material for street paving purposes. With this object in view he wrote to a

number of city engineers in various cities and, through their courtesy, obtained copies of their specifications. The first question which he hoped to have answered by these specifications was: "What are the requirements of a first-class paving brick?" And, second: "What are the tests necessary to determine if the brick come up to these requirements?"

On reading the various specifications over, instead of finding a



EAST RESERVOIR, EDEN PARK, CINCINNATI.

uniformity of opinion, he found almost as many opinions as there were specifications. Some of the writers of the specifications seemed to have no idea of what tests to subject the brick to, or, if they had, seemed afraid to express them in their specifications. In one specification, which we will call "Specification No. 1," under the heading of paving bricks, is found the following:

Paving brick shall consist of the best quality of sound, hard-burned, machine-pressed paving brick, made and burned especially for street paving purposes, and shall stand all reasonable tests as to durability and fitness required by the engi-

neer, and to which paving material is usually subjected; the material to be burned in down-draft kilns or furnaces, all bricks to be square and straight, free from cracks or other defects, of a uniform size and texture of not less than $2\frac{1}{2}$x$4\frac{1}{2}$x 8 inches, and of a quality to be approved by the engineer, and equal to the samples deposited in his office, and in his judgment to be equal to the best samples of paving brick in the market.

The writer hopes he will be pardoned by the author of these specifications for criticising them, and begs leave to assure him that it is done in no captious spirit, but in the hope that it will aid, by bringing out discussion, in determining what are "the tests to which paving material are usually subjected" and be the means of "determining what reasonable tests paving bricks should be subjected to" before they are accepted by the engineer and allowed to go into the pavements.

The writer believes that an engineer should have certain and well-defined ideas as to what materials are fit for a particular work on which he may be engaged, also what tests are necessary to determine the fitness of these materials, and that the specifications should specifically state what the requirements will be. It is only fair to contractors who are bidding on a piece of work that the requirements should be plainly stated, and not say that "the material shall be subjected to such reasonable tests as may be required by the engineer." If a bidder knows, before making up his bid, what he will be required to furnish, both in the way of material and workmanship, he can make his bid intelligently, and know before he bids whether he can comply with the requirements of the specifications. If the requirements are such that he feels he can not live up to them he ought not to bid on the work, for if he is the successful bidder he will only be laying up "wrath to come" in the shape of condemnation by the engineer, and probably financial loss to himself.

The second question, "What are the tests necessary to determine if the bricks are up to these requirements?" is what we are principally concerned in. The question of economy of first cost is easily answered by comparison of the prices of brick pavements with those of stone or asphalt.

The relative economy of maintenance seems to be decided in favor of vitrified brick over cobble or block stone by the experience of those who have had the maintenance of the various kinds of pavements. The question of what shall be the requirements of the

tests for abrasion and attrition is not so easily answered. One city engineer, to whom the author wrote, replied: "There is no test but actual use in the road-way that I consider of actual use." This might prove a very expensive test to a city that is just beginning the use of vitrified brick paving. In fact, the writer knows of one city where one such test has resulted in the department of public works excluding this material for paving purposes entirely; this the writer believes to be a mistake, as in all cities there are streets and alleys on which the traffic is so light that the first cost and maintenance alone would make the use of brick very desirable, and which, by reason of greater cost of other material, would go unpaved for many years. What we wish to know is, "What physical tests can we subject paving brick to?" the result of which, in some degree, indicates the probable wear or life of the bricks in actual use under the traffic they will be subjected to on the streets. Let us see the opinions of some city engineers on this subject as shown by their specifications.

Specification No. 2.—All bricks shall pass satisfactory abrasion and impact tests in comparison with other paving bricks.

Specification No. 3.—Paving bricks shall stand all reasonable tests as to durability and fitness to which paving material is usually subjected.

Specification No. 4.—Ten standard specimen bricks are on file in the office of the chief engineer of the board of administration, which indicate the quality required by these specifications and all specimen bricks submitted must, in the opinion of the board of administration, be equal in quality to the said specimen brick on file or they will not be accepted.

These specifications do not answer the question at all and are open to the same criticism, on the ground of indefiniteness, as the first specifications above quoted.

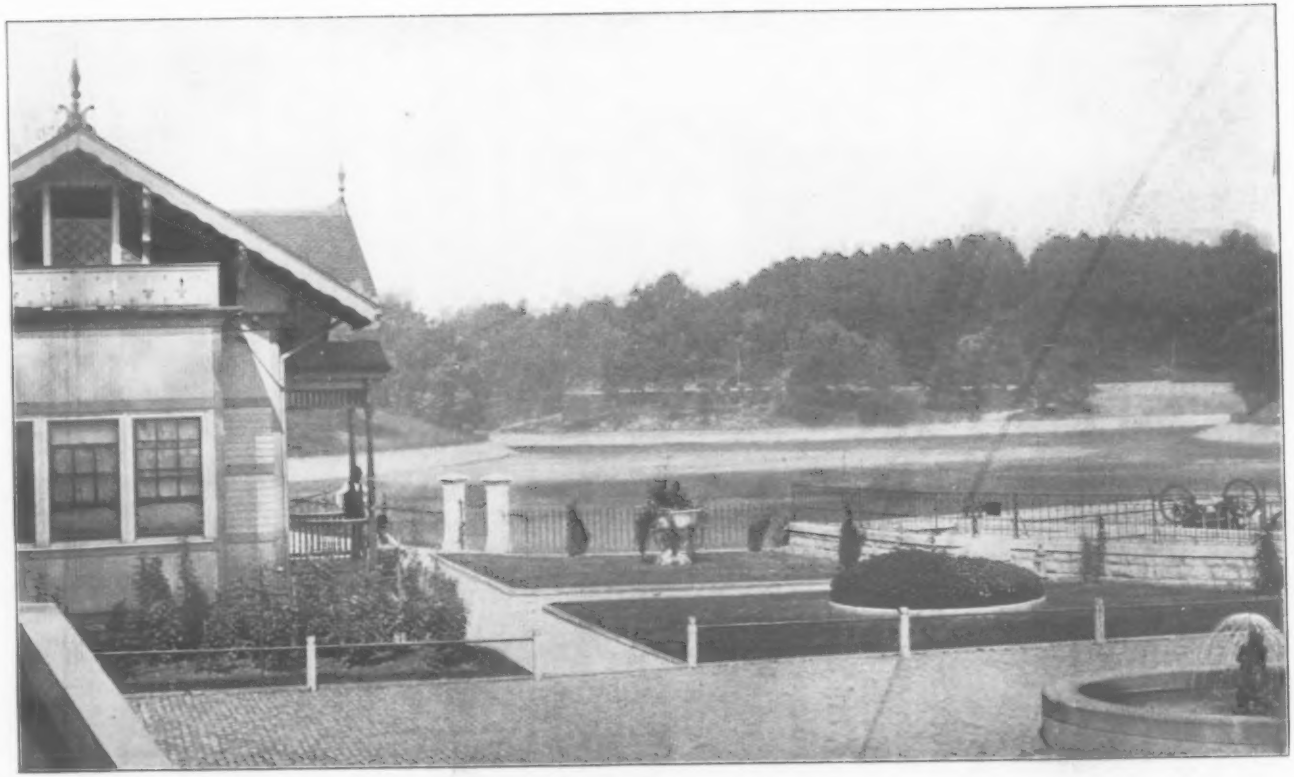
Specification No. 5.—If the average loss of three bricks be more than thirty per cent of their weight when subjected to the prescribed abrasion test, the bricks of which they are samples shall be rejected.

The first tumbling shall continue in a barrel three feet long and two feet in diameter, with thirty to thirty-five revolutions per minute, containing about one hundred pounds of scrap iron and about one hundred pounds of pig iron.

The second shall continue two hours in the same barrel containing scrap iron only.

Specification No. 6.—Such specimen bricks, or as many of them as may be required by the commissioner of public works, shall be subjected to a test of one hour in the machine known as the rattler, and if the loss by abrasion during such test shall exceed eight per cent. of the original weight of the bricks tested, then such bid will be rejected.

The loss by abrasion shall not be more than two and one-quarter times that of Georgia Lithonia granite.



A SCENE IN EDEN PARK, CINCINNATI.

One city engineer writes: "One method of testing has been to rattle six hours at fifty revolutions per minute, the rattler containing five samples of six bricks each, or thirty bricks, with about one hundred fifty pounds of cast iron; a loss of fifteen per cent. is allowed."

Another engineer says: "We make tumbler tests of one hour, the tumbler making twenty-two revolutions per minute. We add for each twelve bricks in the tumbler forty pounds of cast iron in about three-inch cubes; loss not to exceed twenty per cent. of original weight for acceptable bricks."

Another says: "We use a rattler revolving one hour at thirty revolutions per minute, with one hundred fifty pounds of scrap iron, none of which weigh more than ten or twelve ounces."

Enough specifications for abrasion tests have been quoted from to show the great variety of opinions as to what the requirements of this test should be. The time of rattling runs from one hour to six hours, speed of revolutions from twenty-two to thirty-five per minute and the allowable percentage of loss in weight from eight to thirty.

The following are a few extracts from various specifications regarding the absorption tests:

Specification No. 5.—The average absorption of any three bricks must not be more than three per cent. when dried and immersed in water forty-eight hours.

Specification No. 6.—Not less than three bricks shall be broken across, thoroughly dried and immersed in water seventy-two hours. Absorption must not exceed two per cent. of their weight when dry or the same shall be rejected.

Specification No. 4.—Any bricks showing a water absorption exceeding two per cent of their weight shall be rejected. The test shall be made in the following manner, viz: The bricks will be broken across the middle, thoroughly dried and immersed in water seventy-two hours.

One engineer writes: "The absorption test should be made by first drying the bricks taken from the tumbler and then immersing in water for twenty-four or forty-eight hours."

Another engineer says: "After rolling, the brick are dried and immersed in water forty-eight hours, an increase of weight of one and one-half per cent. being allowed."

The variety of opinions regarding the manner of making these tests are almost as great as on the abrasion test. Some make the test on whole bricks, some on half bricks and some on bricks that have

been tested for abrasion, but the percentage of absorption varies slightly, being from one and one-half to three per cent.

A third test on which there is a great difference in the manner in which it is made and the requirements is the crushing test. Sometimes it is made on a whole brick, sometimes on a half brick, some test the brick on the flat and some on the edge. In some cases the brick receives no special preparation for the test, the brick being placed in the machine between two pieces of card-board or sheet lead, so as to aid in distributing the pressure uniformly over the entire surface. Others plane or rub the brick to give two parallel surfaces with the same object in view. The requirements of engineers vary from six thousand to fifteen thousand pounds per square inch.

Still another test very largely advised is the transverse breaking test. This is made by placing the brick on the rounded knife edges, six inches apart, and the pressure brought on the middle of the top face by a rounded knife edge. The breaking load is then divided by the width in inches to determine the breaking load per inch in width. The requirements for this test also vary according to the idea of the engineer.

Enough examples have been given to show the marked difference of opinion as to what the tests are that are necessary to determine the qualities of a good paving brick.

This is a difference of opinion not only as to requirements of the different tests, but the comparative weight to be given the various tests. One engineer will claim that the transverse is the most important, another that the abrasion test is the crucial one, and another may claim the absorption test to be equally important.

It would seem, in view of the largely increasing use of brick as a paving material, that the time had come for some influential body, such as the American Society of Municipal Improvements, to take up the subject, and, after a series of tests made on bricks that have been taken from streets under traffic, prepare a specification that would be a standard for the United States. Such a specification would be a great desideratum, not only for engineers in charge of street paving, but also for manufacturers of paving brick. There has been a committee of the National Brick Manufacturers Association appointed to prepare a standard specification for paving

brick, and this committee has already held one meeting. It might be well for this society to appoint a committee to co-operate with the manufacturers' committee, and by such co-operation a standard specification could be secured which would be acceptable to both the manufacturer and the engineer.

If this were done there would possibly result a specification

ARCH AND VIADUCT, MAIN ENTRANCE, EDEN PARK, CINCINNATI.

which would be fair to both, and the manufacturers could not then say that the engineers had prepared specifications which it were impossible to comply with, and the engineer could not say, "that it was a manufacturers' specification" and the requirements not rigid enough.

The writer's own opinion is that such a specification should cover only the physical requirements to which the bricks would be subjected in testing them, and that they shall not go into details of

the manufacturing process. This is a matter the manufacturers are mostly concerned with, and, if they are given the tests their product will have to pass, they will soon turn out a product that will meet these requirements.

The tests of paving bricks, as well as all engineering material, should be conducted under conditions as nearly as possible the same as they are subjected to in actual use or service. The writer believes there should be an impact test, made on brick supported in a sand cushion of about two inches in thickness, such as are usually laid under all brick pavements. What the requirements of this test should be can only be settled after an exhaustive series of experiments have been made as outlined above.

W. G. WILKINS, C. E.

The author's purpose in writing this paper has been to call attention to the importance of standard tests for paving brick, and if it shall in any degree assist in preparing such standard tests, its purpose will have been accomplished.

F. W. CAPPELEN, City Engineer, Minneapolis—I would like to ask Mr. Wilkins which plan he adopted.

MR. WILKINS—I prepared the specifications, but it was done very hurriedly and I admit it is open to criticism. I will read the test I prepared, but if I have to prepare specifications next year I would change it somewhat:

"All brick to be tested by the director of the department of public works. Test to be made from samples of brick delivered for use on the street. Six samples selected by the engineer in charge will be used and tests made as follows: 1st, crushing; 2d, abrasion; 3d, absorption. Crushing tests to be made to determine accurately the weight required per square inch to crush the bricks. Abrasion tests will be made by placing brick in a rattler along with 400 pounds of iron castings, each weighing from five to seven pounds; speed of rattler, forty revolutions per minute; time of rattling one hour. Weights to be taken before and after rattling. Absorption tests will be made by immersing half bricks in water for twenty-four hours; weights to be taken before and after immersion. The tests must show the following results before the brick will be accepted: 1st, crushing, not less than 8,000 pounds per square inch; tests to be made on half brick on edge; 2d, abrasion, reduction not more than 3 per cent.; 3d, absorption, increase not more than 2.5 per cent."

Those tests I prescribed after having a series of tests made on about twenty-five sample bricks, made to meet all the various manufacturers that proposed to furnish brick to the city. These requirements were all very much lower than the results shown by those sample bricks. For instance, on the crushing test, I had a large number of tests run over 15,000 pounds—some ran as high as 19,000 pounds; the average was about 13,000 pounds. I placed my requirements not more than 8,000, thinking that was very much greater than any loads that would come on

them in use. In the rattler test I used 400 pounds of cast iron, which is more than I know of any other city using. With that the greatest abrasion was 5.67 per cent. Some went much lower. I put the test at 3 per cent.

Q. How long did the test last?

A. With 400 pounds of cast iron, one hour. The specifications of other cities allow from 8 to 30 per cent. of abrasion. From the result of my own test I thought 3 per cent. was high enough. In fact, I found one brick had practically no abrasion.

Q. How large was the cylinder?

A. Three feet long and two feet in diameter, forty revolutions per minute.

Q. What shape was the cast iron?

A. Ordinary rough pieces of rough iron. None of them weighed over seven pounds.

Q. What proportion of your rattler was filled?

A. I think it was about half full. I put in six bricks at a time—six bricks of each kind.

Q. What brick was it you adopted?

A. This preliminary test of the bricks presented by me to the manufacturers was made before I drew up the specifications. Our contracts simply required that the brick come up to the specifications. I have had contractors come in and ask what brick I preferred. I said I did not care what brick they had, so they came up to the requirements. If they could buy such brick from others than those they had been buying from for less money, they would be foolish if they did not do so. All the engineer was concerned in was the result of the test of the brick. If they fulfilled the test that was sufficient.

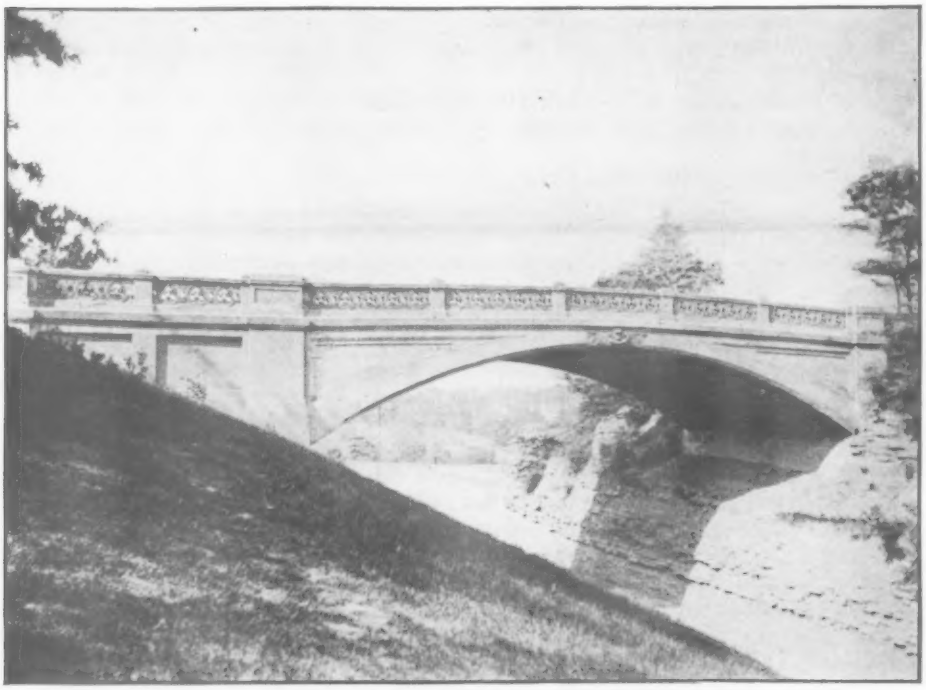
Q. I notice in your paper you speak of testing a brick on a cushion foundation?

A. I think it should be done. It is put on a cushion in the street, and I think it ought to be put on a cushion foundation and tested by a blow. We always place in our city six inches of concrete, two inches of sand, and the brick on top of that.

Mr. Kent, of Chicago—We have in the city of Chicago about a mile and a half of vitrified brick paving. When laid it raised considerable discussion, and finally I decided that it would be best for the city to make a test of various kinds of brick, and for that purpose I have had the contractors submit me samples. I also appointed a man to visit different mills. I believe that he visited eighteen mills, and he went right to their yards, and he got ten samples from each mill. At the present time, we are having a test of the different samples, and the man who is making the tests is an expert in the matter of brick. I regret very much to say that I can not give you to-day the result of the test, but it will all be completed in about two weeks' time.

Ernest Adam, City Engineer, Newark, N. J.—The city of Newark decided for the first time to lay some brick paving. It was to be laid upon a six-inch concrete base. The experience of the city has been that the asphalt paving was practically controlled by one company, and that the price per square yard was held very high, some of the pavings costing as much as $2.90, providing for a six-inch concrete foundation with two and a half inches of asphalt covering. This year it costs but $2.68 to $2.72, consisting of six inches concrete, one and one-half inches binder course, mixed with asphalt, and two inches of asphalt covering. The board of works, the engineer of the water department, and myself went to Philadelphia and Trenton to examine the brick paving of those cities. From what was seen,

it was concluded that brick paving was no longer to be considered an experiment. We, therefore, set about getting up specifications. In preparing them I experienced the same difficulty that Mr. Wilkins spoke of. I requested several engineers of other cities to favor me with a specification for brick paving as used in their place. No two were alike. Mr. Sherrerd, the engineer of water department, who had some experience in brick paving in the city of Troy, N. Y., as former city engineer of that place, by the request of the board, assisted me in getting up the specifications and making the tests, which were to determine the



CONCRETE BRIDGE, EDEN PARK, CINCINNATI.

conditions under which bids were to be accepted. The brick manufacturers, upon hearing that the city intended to put down brick pavements, sent their samples very freely. We received about thirty-four different makes. It was determined to make the absorption test by taking half bricks and drying them for twenty-four hours in a baker's oven, and then immersing them in water. From the results ascertained, it was decided to make the absorption test 3 per cent. For abrasion, two bricks of each kind were put into a tumbler, with 150 pounds of scrap iron, consisting of pieces weighing from one to five pounds. The tumbler measured two feet in diameter and four feet in length, revolving at the rate of forty-three revolutions per minute. After the first twenty minutes the brick were taken out and weighed. They were put in again and subjected to twenty minutes more tumbling. The average

loss of weight of the first twenty minutes and that of the second were added and the average of the two adopted as the per cent. of loss. It was concluded to make the per cent. of abrasion 8 per cent. The modulus of rupture was fixed to be 8,000 pounds to the square inch. Only eight of the thirty-four samples passed the test successfully. These percentages were stipulated in the specifications. Any bidder was permitted to present new specimens of brick, or new samples of those which had been previously tested. This may have been a severer test than called for in other places, as some brick, which were used in brick paving in other cities, and apparently giving entire satisfaction, had to be thrown out, as they did not come up to the requirements of the test. I therefore think that Mr. Wilkins is correct in his view, that it would be wise and also just to the brick paving manufacturers, that this association appoint a commitee to co-operate with the one appointed by the brick manufacturers, to ascertain and establish a fair and uniform test of paving bricks, such as has been established by the American Society of Civil Engineers in the matter of cement tests. My belief is that there is a wide field for brick paving, and that it will tend to moderate the price for asphalt pavements, which, in a certain measure, are considered a monopoly.

A. D. THOMPSON, City Engineer, Peoria—Our specifications this year are based entirely on the tests made last year. The city of Peoria at that time made more extensive tests than any other city in the United States. We tested 125 different lots from fifteen or twenty factories, and on the results of our tests drew up our specifications, making three requirements—requirements as to abrasion, transverse strength and absorption. These lots were not samples submitted but were taken from bricks delivered on the streets. In the abrasion test the bricks were put into the rattler for on ehour with 300 pounds of scrap iron and revolved at the rate of 15 revolutions per minute. The scrap iron ranged from a quarter of a pound to five pounds in weight. Mr. Wilkins' results surprise me by the low results of abrasion. Our rattler got to giving very low results of abrasion, and I found it was so smooth that the bricks, instead of tumbling, went sliding around. To overcome this difficulty I bolted wrought iron strips on the inside of the rattler, and after that we got very satisfactory results. In connection with the very great difference of opinion of engineers as to what is required as to brick, the last meeting of the Illinois Society of Engineers and Surveyors appointed a committee to investigate the question and recommend to the society standard tests and requirements of brick and sewer pipe. The rattler was two feet in diameter and three feet long, filled one-sixth with brick, and contained 300 pounds of scrap iron.

IMPURITIES IN PUBLIC WATER SUPPLIES.

By John W. Hill, C. E.

THERE is no question of more importance to us, when viewed from a hygienic standpoint, than the purity of our public water supplies, especially with reference to the propagation of typhoid fever by means of sewage-polluted drinking water. In the United States alone the health statistics from the largest cities show at the pres-

ent time an average annual loss of more than 35,000 lives by typhoid fever, or about one in every 2,000 of the current population. Considering that this disease is due altogether to preventable causes well understood by sanitarians, it would seem that such an alarming loss of human life should direct the attention of public officials and hygienists to prompt and vigorous measures to check its ravages, or wipe out the disease altogether,

The pumping of water for domestic uses from a source known to be polluted by sewage, or otherwise, can not be too strongly condemned.

Water is an essential of human existence. Ninety per cent. of the liquid portion of the blood is water, and of the corpuscles or disks in the circulation nearly 70 per cent. is water. Of all the many articles of diet upon which we subsist, none is so important to the support of life as water. With all other articles of subsistence we are usually very careful not only to demand the best, but to insist that they are absolutely safe to take into the human system. With water, however, we drink whatever comes most conveniently to hand, with no inquiry and seldom a thought as to its fitness for the purpose to which it is applied in the animal economy; and yet one of the most dangerous of diseases—typhoid fever—can be established in the human system through the medium of drinking water. For even in the few instances of its being traced to the distribution of an infected milk or other article of diet, it has been shown that the remote cause was a typhoid-infected water.

The question of procuring a satisfactory supply of potable water for large communities is well understood by the engineers engaged in this line of work. Sources of supply which ten or fifteen years ago were thought to be safe in a sanitary aspect, are now open to grave suspicions of quality, and it is not extravagant to assert that few of the larger cities of the country enjoy a source of public water supply which satisfies the most ordinary requirements of a potable water.

No city in the United States has made a stronger effort to protect the watershed from from which it obtains its water supplies than Boston, and but for this vigilance and great expense to diminish the sewage pollution of its water sources, the death rate of the city from typhoid fever would probably be among the highest in

the country. The increased sewage pollution of rivers and lakes, which might furnish a safe drinking water, is partly responsible for the difficulties surrounding this problem. But apart from the special sewage pollution by organized communities, there is a pollution of streams and lakes from the ordinary surface drainage of agricultural watershed, which often renders the water of such unfit for drinking purposes.

Several years ago, in discussing this question, the speaker took the ground that as the proportion of water used for drinking purposes was one-half per cent. or less of the whole quantity consumed by the takers from a public source, the better plan was not to attempt to secure the whole supply as of potable quality, but to render any water available fit for drinking purposes by domestic filtration. Later experience satisfies me that this plan will not answer for several reasons:

1. All consumers of public water supply can not or will not use domestic filters.

2. There is no domestic filter which is absolutely proof against the passage of disease germs and the toxic properties in a polluted water.

3. Even if a satisfactory filter was obtainable it is doubtful if the average householder would give this the attention it would require to keep it at all times in condition to act as a safeguard.

In view of which I have reached the conclusion that if the consumer is to have a safe drinking water, it must come to him in this condition through the public water mains. In other words, the matter of purity must be looked after by the municipal corporation. The prevalence of typhoid fever in many cities having a public water supply is evidence that the water now furnished to consumers is unpotable, and that the municipal corporations are furnishing to their consumers the bacillus of Eberth, or the specific virus of typhoid fever.

It is too frequently asserted or implied in text-books and reports on sewerage that the noxious properties in sewage are destroyed or safely mitigated by proper dilution; but if sewage should be the carrier, as it often is, of pathogenic germs, how can dilution remove them? It may reduce the number per unit of volume of the mixed sewage and water, but the germs are still there, and when

taken into the system through drinking water may produce just as serious results to just as many people as if no dilution had occurred. Dilution may reduce the chances of any single individual imbibing a fatal germ, but the germ itself will be quite as dangerous when it is imbibed.

In reports of filters tested for the reduction of bacteria it is customary to state the condition of the water after filtration in the re-

ART MUSEUM. ELSINORE TOWER.

maining bacteria cu. cm. These are given as the average per cu. cm., and sometimes the number after filtration may be as low as three or four, and I have seen it stated in some reports as low as one per cu. cm. An ordinary drinking tumbler contains half a pint, or about 230 cu. cm., and with the best of filtered water so low in bacteria as one or two cu. cm., a person may imbibe from 250 to 500 bacteria in a single glass of water, some of which may be pathogenic and produce typhoid fever or some other disease.

A careful investigation of the subject of bacteria in a water supply seems to lead to the following conclusion:

If the source of water supply is beyond the reach of sewage contamination the probability of finding pathogenic bacteria in such water is very remote, because those of which we stand in awe, the typhoid and cholera germs, are not indigenous to water, but are always imported into it, generally from sewage sources. Upon the other hand, if the water source be exposed to sewage contamination and bacteria are found in such water, it should promptly be condemned for drinking purposes. It is a singular fact that in several instances where pathogenic bacteria have been found in water (excepting, of course, sewage effluents) the number of bacteria of all kinds per unit of volume of the water is small. A statement, therefore, that by a certain process of purification the number of bacteria in a given water has been reduced from say 1,000 to four cu. cm. is not convincing proof of the capacity of such process to eliminate disease germs, because four bacteria per cu. cm. mean upward of 1,000 in a single tumbler of water, and among 1,000 bacteria left in any sewage-polluted water there is a possibility that some may be pathogenic germs, provided such were in the water before treatment.

The presence or absence of fish in water has often been mentioned as a test of quality. Certain kinds of fish, like the carp, for instance, are often found to flourish in water known to be polluted by organic wastes; while others, more fastidious in their tastes, like the mountain trout, are never found in any but the clearest and naturally purest upland waters. In all cases, however, there must be enough organic matter in order to support even fish life, and an estimate of the quality of any water supply from the presence or absence of any particular kinds of fish would only be relative. A water wholly destitute of organic matter could not support fish life, while in a water heavily polluted with sewage wastes certain kinds of fish would die for lack of free oxygen. It is held by the most experienced observers in this line that, after all, the typhoid fever death rate of any city is the best test of the quality of the public water supply, and, as interesting information in support of this view, I desire to call your attention to some figures from the typhoid fever statistics from sixty of the largest cities of the United

States and Europe for the past five years. The figures which I will quote will be the number of deaths per 100,000 of population living. From the table which I have before me the lowest death rate for the past five years is found at The Hague, in Holland, where in 1893 the loss was but two per 100,000 of population living, while in Chicago, for the year 1891, the loss was 160, or 80 times as great as that of The Hague. London, with its heterogeneous population of over 4,000,000, and with districts like Shoreditch, Clerkenwell and Whitechapel, among the people of which even the instincts of hygiene are unknown, during the past five years has never had a typhoid fever death rate in excess of 16 per 100,000 of population, and in 1892 the death rate from this disease was as low as 11. In 1892 the death rate of Chicago was 104, or nine and one-half times that of densely populated London. Referring to the city of Newark, N. J., before the new source of water supply from the Pequannock river was brought into the city, the death rate from typhoid fever ranged from 45 to 81 per 100,000 of population. After the new source of supply was drawn upon the death rate (1894) fell to 15 per 100,000 of population, or about the same as the average rate for the past five years for London. Berlin, which draws its water supply from the River Spree and Lake Tegel, has at no time during the past five years had a death rate in excess of 10; while in 1894 the death rate from typhoid fever was as low as four per 100,000 of population.

Meanwhile Washington City, the capital of our country, which draws its water supply from the sewage-polluted Potomac river and delivers it to its consumers in the same condition in which it is taken from the original source, at no time during the past five years has had a death rate from typhoid fever of less than 66, and at times as high as 83 per 100,000 of population, or an average for the past five years of nine and a half times that of the City of Berlin. Vienna, which draws its public water supply from springs 60 miles distant, in the Schneeberg, has had an average death rate for the past five years from typhoid fever of 7, while Pittsburg, which draws its water supply from the Allegheny river, for the same time, has had an average death rate of 92, or thirteen times that of Vienna. Munich, whose public water supply is obtained from springs, during the past five years, has had an annual death rate

from typhoid fever of 7, while Lawrence, Mass., which draws its water supply from the Merrimac river, during the past five years has had an annual death rate from typhoid fever as high as 123, in 1890, and as low as 48, in 1894; or, taken for the entire period of five years, nearly 14 times that of Munich.

Some objection, possibly, will be made to a comparison of the public water supplies and typhoid fever rates of the German and American cities, owing to the generally large consumption of beer and presumably small consumption of water as a beverage by the people of the foreign cities. The per capita per annum consumption of beer in Berlin is said to be greater than in any other city in the world, and is stated at one time to have been as high as 128 gallons. It is a well-known fact that great quantities of beer are consumed in several of the large cities of this country, but few would suggest that the total consumption of domestic beer in the United States amounted to 33,000,000 barrels during 1894, which would allow every man, woman and child from 15 to 16 gallons per capita. It is in the principal cities, however, where the largest consumption occurs, and from imperfect statistics, although at the present time the best obtainable, the local consumption is given as follows:

	Gallons per capita per annum.
Boston	65
New York	78
Brooklyn	60
Philadelphia	51
Chicago	54
Cincinnati	80
St. Louis	93
Cleveland	46
Buffalo	65
Milwaukee	105

These figures are derived from a table in the Brewers' Handbook for 1894, and are not presented as an accurate statement of facts, but taken even as very rough approximations they serve to show that we are not far behind our friends of the German cities in the worship of King Gambrinus. Doubtless the use of beer is more general in the cities of Germany than here, but that they do not depend alone on beer is shown by their extreme solicitude for the quality of their public water supplies.

A moment's reflection should convince any one that cities like

Cincinnati, Pittsburg, St. Louis, Chicago, and many others in this country, which take their public water supplies from sources known to be the receptacles or channels for the discharge of the sewage of hundreds of thousands of people, and deliver this water to their consumers, with none at all, or insufficient purification, can not expect to escape the penalty for such flagrant disregard of the fundamental laws of health.

Consider that the death rate from typhoid fever during 1894 for Cincinnati, as an example, was over three times that of London, eight times that of Hamburg, ten times that of Vienna, twelve times that of Berlin, seventeen times that of Christiana and twenty times that of Munich, and then decide whether there is not just cause of complaint of a public water supply which leaves its mark in history at such an awful cost of human life and suffering.

G. H. BENZENBERG,
President American Society of Municipal Improvement.

In my paper on "The Sterilization of Our Drinking Water to Prevent Typhoid Fever," read at the Eighth International Congress of Hygiene and Demography, held at Budapest, September, 1894, I endeavored to show that absolute safety from disease germs in a polluted water supply was to be had only by filtration, to remove the grosser impurities, and subsequent distillation to eliminate all bacterial life and toxic properties in the water, and, by illustration, for a city about the population of Cincinnati when all the contiguous villages have been annexed, deduced an annual per capita cost for fixed charges and operating expenses of about $1, or a cost per gallon of water treated of about one-tenth cent.

I estimated at that time that about 2½ per cent. of the total water supply was used for drinking and other dietetic purposes.

Many objections have been raised to this method of securing and distributing a potable water; the only one worthy of consideration, however, is the cost; and, with a view to reaching better knowledge than most of us possess on other methods of water purification, and in the light of the necessity now, and perhaps at all times, of

Cincinnati being compelled to take its water supply from the sewage-polluted Ohio river, I have, during the past year, sought exact information upon the effect of sedimentation in large, deep reservoirs, such as we have in the water-works of Liverpool and Boston, and upon carefully conducted sand filtration as practiced in the Berlin and Hamburg water-works, and in several of the cities of Holland, and from this I feel that it is possible, by combined sedimentation, and what I would term multiple filtration through thick beds of graduated sand, to produce from the polluted water of the Ohio river as good an effluent as that supplied to any foreign city.

MR. RATLIFF, of Richmond, Ind.—We have at this time in the little city of Richmond, with about twenty thousand inhabitants, more than one hundred cases of typhoid fever. Careful examinations have been made as to the origin of these cases among people who are using water from wells. The water supply system of our city, we think, is very pure. It consists entirely of spring water, and very little of it sees daylight until it gets into the city, but our city having been well supplied with wells ever since its existence, a great many people prefer to use well water instead of that from the water supply system, and the impression seems to prevail in our city that the well water is accountable for the large number of cases of typhoid fever we have.

MR. HATHAWAY—I saw it stated some years ago during the cholera epidemic—I think it was in Amsterdam—that the water purified itself by flowing seven miles, and therefore the cities that distance below the contagion will not be in danger. I would like to ask your opinion in regard to that matter.

MR. HILL—I think I can answer Mr. Hathaway's question by referring to our Ohio river water. By some recent experiences that I have had I find that the bacteria lives about sixty days. It perishes in between sixty and ninety days, and you can conceive that in sixty days it will come from the headwaters of the Allegheny or Monongahela rivers and reach every city on the banks of the Ohio. There is some purification by flowing, partly by sedimentation, partly oxydation, but I don't believe that any sewage water will ever purify itself by flowing any distance. Now the experience with polluted rivers in England reaches to this conclusion, that there is no river in that country, at least, long enough to purify itself of any pollution. I know it is a fact that there are many text-books that will tell you that in ten miles, or in twenty miles, water will be purified. My experience leads me to believe that this is a great mistake; it can not be measured in distance. It might be measured in time. When I tell you that after years of experiments I found the typhoid bacilli to live in our water for sixty days you can conceive that in two months' time the Ohio river will travel a great distance.

MR. WILKINS, of Allegheny—Could any means be devised for a water supply for domestic consumption and another for manufacturing consumption?

MR. HILL—In my paper I left out the item of cost altogether. I simply was considering the hygiene. I think every city should have two water supplies, one that furnishes the water for drinking, cooking, and such domestic purposes as

occur about the kitchen, and the other for manufacturing and for the flushing and sanitary appliances.

MR. WILKINS—What will be the cost of the entire consumption of the two systems?

MR. HILL—I have not the cost. I spent considerable time on this question of sterilization by heat; it has been a curious study, and with the aid of my friend Emery we have brought it to a practical system. Every city should have a water supply for drinking and cooking purposes and water sterilized by heat; and what I say in this paper is, that I believe that the Ohio river water can be made quite as good as that of any foreign city, and if it was made as good as that of The Hague it would be just 25 per cent. better than it is to-day.

MR. KEYT—Mr. Hill, would not in time the sand be so affected as to be useless as a medium of filtration?

MR. HILL—You understand, gentlemen, that in speaking of a sand filter I have in mind a form of bed that is largely used which may cover from one acre to several acres. About all the bacteria is found right on top of the sand; that sand is then washed after having been taken away and is then put back on the bed, or in some cases like in Holland they take new sand as being cheaper than washing the old sand; but whilst it is true that the filter closes and its clogging is an evidence of its doing its work, the sand from time to time must be taken up and that is done in some cases by mechanical appliances.

MR. CAPPELEN—In Minneapolis during the winter time the Mississippi is in fairly good condition, but from April until September it is very bad, outside of any sewerage pollution. We have as high as 9-10 of ammonia for one million parts and some twenty hundreds of free ammonia during the summer months. Now I would like to ask you if the chances for the disease-breeding germ is not by far more severe when you have from fifteen to twenty hundreds of ammonia in the water?

MR. HILL—I think, Mr. Cappelen, that of course the bacteria require very little to live on, but there must be something there for them to live on. I do not think it is true that the typhoid bacillus flourishes best when the water is most polluted, but rather when the ordinary bacteria are not at a reasonably low ebb; there are certain hearty species of bacteria that will drive out the typhoid bacteria, and it has been suggested in some German work on this line that we might eventually find what bacteria is antagonistic to the typhoid bacillus and that, by putting them in, we may kill it; but there is no intimation to that effect at the present time. It is true, I think, if we were to take a heavily-polluted water and sterilize it, it would kill all bacteria life in a very short time, but we do not know what particular kind of bacteria is instrumental in killing the typhoid bacillus, so that I think in your case the danger would be greater even when the ammonia were eliminated.

EXPERIENCE WITH IMPROVED STREETS AND SEWERS.

By W. B. Holton, President Board of Public Works, Indianapolis.

MUCH of the progress which I claim for Indianapolis in the past four years is due largely to the fact that its affairs have been conducted on broad business principles, and for the additional reason that no member of the board is subject to the whims or dictates of political bosses or ward managers. When, under the law, you can hold a mayor of a city personally responsible for the proper conduct of the city's business, as the people are able to do in the city which I represent, it can not but result in a more rapid advancement of her interests in every respect.

The department of public works has under its jurisdiction the control and regulation of street building, as well as the management of the public lighting and water system of the city. Indianapolis, under the new order of things, has grown from a city having a population of 107,000, in 1891, to a city of about 175,000 inhabitants at the present time. This is due in part to the advancement made in the building of good streets, the construction of public sewers, and the improved sanitary condition of the city.

As I have the honor to address the convention more especially on the subject of our experience in street building and sewer construction I will confine my remarks to these matters.

In 1891 there were less than two miles of improved roadways in our city. To-day we have forty-five miles of improved streets, of which twenty-five miles are asphalt, fifteen miles brick and the remainder of cedar block and macadam.

Before and since I have had the honor to be connected with the city government there has existed much controversy as to what constitutes the best permanent improvements that can be laid. In the introduction, in 1891, of brick pavements in Indianapolis, a selection of what has proven to be inferior brick was made by the board of public works. An experience of three years has demonstrated to the satisfaction of the city officials and all interested property owners that no greater mistake could have been made than to select a poor quality of brick for street paving purposes. Such a street

will, in two years, become worse than a bowldered road-way in the same length of time. Fortunately for us, we have but a mile or two of such pavements. I trust the cities represented here will profit by the experience of Indianapolis and in the construction of brick streets use only the best material obtainable. The board of public works first appointed provided in their specifications that only brick 2¼ x 4¼ x 8¼ in. should be used. Experience has shown that such sized brick will wear faster and the roadway become rough sooner than where a larger brick or block is used. We have chosen for use the present season a block 3 x 4 x 9 in.

AUG. HERRMANN,
First Vice-Pres. American Society Municipal Improvements.

Our method of construction has been, on the principal business and residence streets, to lay the brick surface on a six-inch Portland cement concrete foundation with a two-inch cushion of sand between the brick and concrete.

Last year there was constructed some six or seven squares of cedar block pavements, the blocks selected being cylindrical in form, laid on an eight-inch broken stone foundation thoroughly rolled. This pavement has been down a sufficient time to demonstrate to the board that such pavement is not desirable. We are laying some cedar block pavements in Indianapolis this season—some two miles in length—but the blocks are rectangular in shape and laid on a six-inch concrete foundation.

We are experimenting at the present time in the construction of two miles of macadam roadway, that to be laid on Capitol avenue from Ohio street to Twelfth street, one of the main thoroughfares of the city. The demand has come from many of the owners of property for the building of a boulevard drive and we have endeavored to meet this sentiment. Its trial for a few years will demonstrate whether the people of Indianapolis will favor the continuation of such improvements.

Much contention has existed in our city as to what character of asphalt should be used for street paving in order to obtain the best results. The use of what is known as "coal tar" or "vulcanite" pavement was at once abandoned by the board of public works first

appointed to office. The board provided in the specifications for asphalt streets that nothing but Pitch Lake asphalt, mined directly from Pitch Lake in the Island of Trinidad, should be used.

During the years of 1891 and 1892 companies representing and dealing in the "overflow" or "land" asphalt made strenuous and determined efforts to secure the admission of their material. Much evidence was adduced to show that such asphalt would make an improvement equally good and equally lasting as that made with Pitch Lake asphalt. After a full investigation and consideration of the evidence produced, the department unanimously ruled against the introduction of the "overflow" or "land" asphalt. It was the decision that while it would be possible to lay a good and lasting pavement with this material, the opportunity for making inferior improvements with it was too great to allow of any experiments. This decision has been adhered to to the present time.

In the spring of 1893 a number of responsible business men of our city formed a company securing the right to handle the Bermudez asphalt. They came before the board urging the merits of this material. A thorough investigation was made by the board and the city engineer as to the claims made for the Bermudez asphalt. Our engineer visited the cities of Utica, N. Y., and Detroit, Mich., in both of which this pavement had been laid, and he reported to the department that he could see no difference between the Bermudez and Trinidad asphalt so far as appearances were concerned. The information obtainable decided the board in favor of the admission of Bermudez asphalt, and we have in the two and one-half years since its introduction laid over 50,000 square yards of this pavement.

During the present season efforts have again been made to secure the introduction of the "overflow" asphalt, as well as to permit the use of what is called Mexican asphalt, and another thorough investigation was had, but the department refused to allow the use of either, fearing that such a step would result in the deterioration of the quality of our asphalt pavements. We have no reason to regret the introduction of Bermudez asphalt, as the pavements laid with it are, to all appearances, as good as those in which the Pitch Lake asphalt has been used.

We have some beautiful asphalt roadways. They are broad,

well drained, well shaded, kept clean and are in uniformly good condition. There is a growing sentiment in favor of asphalt as against brick, and it is now an exception when a brick pavement is laid on any of the principal residence or business streets of the city.

As to the method of construction at present of permanent roadways our pavements have been laid, unless on a very light traffic street, on a six-inch Portland cement concrete foundation. Some demands have been made by the property-owners for the use of artificial curb, and in some instances the board has selected this. We believe, however, it is best suited for residence streets and have only encouraged its use in such portions of the city. While Indianapolis has laid a few of the light standard asphalt pavements—four inches of concrete and two inches of asphalt—such construction is not the rule, the standard pavement giving the most satisfactory results, and has been most generally adopted.

The first important work undertaken by the board of public works under the new system of government in Indianapolis was to map out a correct sewerage system. The services of Rudolph Hering, of New York City, an engineer of high authority on this subject, were secured; and, with the assistance of the engineer employed by the city, a full and comprehensive report was submitted to the board in June, 1892. The report of Mr. Hering was adopted and the construction of a system of works at once commenced, involving, before its completion, it is estimated, an expenditure of something over $4,000,000.

The construction of the sewerage system of Indianapolis, which, I may say, is well toward completion, is, and has been, based upon some fundamental principles, of which the following are a few:

First. A system which will answer the demands of a large modern city, anticipating a population of 240,000 persons.

Second. The construction of a system designed to carry the foul waters to a proper outfall and in such a manner that there remain no deposits of filth, or facilities for its putrefaction, within the populated parts of the city.

Third. All ground water to be kept out of sewers by making them water-tight, because such water can well enter the nearest natural water-course.

Fourth. A proper formation of sewer junctions to prevent eddies, deposits, and eventually the destruction of the junction.

Fifth. Junctions, or taps, for house connections, to be built into the sewer when originally constructed opposite every house or lot so as to avoid breaking into the sewer later.

Sixth. The construction of sewers in alleys where practicable to avoid the tearing up of pavements.

Seventh. To use judgment to give sewers and drains the proper size. If too small, sewers are liable to be obstructed and drains gorged. If too large, they facilitate the deposit of suspended matter and add a useless expense in the construction. The least size for a public sewer is usually taken at eight inches, where no street water, but only sewage and roof water, enters the same. The smallest size for a sewer receiving the surface water from a paved street should be ten inches, and from an unpaved street twelve inches in diameter.

W. R. KERR,
Second Vice-Pres. American Society Municipal Improvements.

Eighth. An avoidance of careless construction. We have not accepted the erroneous notion of many, that because sewers are covered up and out of sight, the character of the work may just as well be second-class.

If the sewers are carelessly built their advantages may be largely lost. All brick used must be hard burned and of regular shape to make a smooth interior surface and resist erosion by constant wear. That this matter of smoothness for interior surface, beside being a sanitary measure, is also one of economy, will be seen from the fact that a two-foot, semi-circular channel built of rough-rubble masonry discharges but one-half as much water as a vitrified pipe of the same semi-circular section, on the same slope, or as a semi-circular channel with a smooth surface made with a plaster of pure cement.

It is important, in my opinion, to provide for the inlets to all sewers to be amply large, and thus reduce to a minimum the difficulty so often noticeable of the inability of the surface water to rapidly drain from the street into the sewer. The necessity of this was demonstrated to our people on the night of the 3d inst., when

seven inches of rainfall fell in twelve hours. In portions of the city where the new system of works had been constructed with large inlets the water was well cared for, and there were few complaints of overflows. In other portions of the city where the old system of sewers prevailed, with small inlets and fewer of them, the complaints were numerous of overflows from the streets into the cellars of adjacent property. It has been demonstrated to us in some cases that it is better to follow practical methods rather than to adopt and depend upon theoretical ideas entirely in the construction of a sewer system.

MR. ROBERTS, of Saginaw—Do I understand, from the paper just read by the gentleman, that the Mexican asphalt has been admitted in the specifications of Indianapolis?

MR. HOLTON—It has not.

MR. ROBERTS—Have you had any experience with the Utah asphalt?

MR. HOLTON—No, sir.

MR. ROBERTS—That is a material, I believe, that this season has been introduced into cities outside of Utah. We have had some experience with contractors and their bids. I understand that some has been laid in Minneapolis and St. Paul, and I would like very much to hear from the engineers of St. Paul and Minneapolis.

Mr. CAPPELEN.—We have a Utah asphalt pavement in Minneapolis of about twenty thousand yards completed in the last two weeks, and I am pleased to say that it is, as far as I can judge, turning out first-class. This so-called lime rock asphalt—it is lime rock, impregnated with bitumen—is found in the mountains of Utah, and is pulverized and treated with a matter, as in our case, called asphalta and Pittsburg flux. There is very little pretroleum oil in it; it is put down in one coat of three and a half inches in original thickness, and rolled down to two and a half when it is completed, and it gives all the indications of turning out first-class pavements. Of course, I don't know what effect our severe winters may have on it, but as far as appears and its actions at present indicate it is first-class. One feature about it makes me believe it will probably stand our winter better than any other asphalt, as in endeavoring to cut it out we can only do so with axes and picks, and cut out only so much by the teaspoonful. You can not pick through the stuff at once, but you have to pick it out by half-inch layers at a time, so that as far as I can judge at present, the material is all right. If we meet again next year I will be able to give you more information on the subject. I believe ours is the first city to try this pavement east of the Rocky Mountains. In Salt Lake City I found that some of the material had been in use there two years and some four years. I took some samples of those pavements and these samples give every indication of being very good material, indeed. As a result, in my specifications, I let everybody in. Before we only permitted the Trinidad Lake pitch asphalt. Their prices used to be $2.75 under a five-year guarantee, and in letting in the other companies asking for a ten-year guarantee there was a reduction in Trinidad prices from $2.75 to $2.15 per square yard. The Utah people bid $2.49 a yard and were awarded the contract, through no fault of mine as engineer. The lowest

bidder in this case was the Warren-Scharff Co.; but, as in many communities, the committee in charge awarded this particular contract, and it was given to the American Asphalt Co., and the Warren-Scharff people were left, although they were 30 cents lower per yard.

MR. KENNEDY, of Nashville—May I ask the gentleman who just read a paper on asphalt, if he, or any other gentleman present, knows anything of what is called the Kentucky asphalt, which is found in some of the lower counties in Kentucky? There are large deposits there of sandstone with a great per cent. of pitch in it. The parties who have that have been trying to place it upon the markets of the country, claiming that it would make very good asphalt streets. There has been some shipped to our city, and we thought we would have it crushed, and some used on the macadam street and some as a binder. We have not had satisfactory information yet to warrant us in making that experiment, and thought it possible that you or some other gentleman present had examined that. If so, I would like to have the benefit of your experience.

MR. HOLTON—We have not experimented with Kentucky asphalt. I doubt, however, whether our board would care to experiment with something of that character unless we could get some practical tests. There are some methods of testing asphalts, and we have said to all those who have brought these new asphalts that unless they brought some character of a test, we would not experiment with it.

MR. CLARK, of Peoria—I would like to ask the gentleman what are the specifications this year as regards the concrete and the thickness of the asphalt?

MR. HOLTON—Our specifications this year called for six inches of Portland cement concrete base, with a two-and-a-half-inch top.

MR. CLARK—What were your prices?

MR. HOLTON—We can hardly compare one street with another. Our grades vary very much and therefore it is hardly safe to gauge a price where the grades are already established. However, we are getting all our streets practically this year at $2.25. We had some streets last year that we got for less than that, owing to some irregular competition that brought the price down, but that was simply temporary.

MR. CLARK—How do you determine whether you get Pitch Lake asphalt or land asphalt?

MR. HOLTON—The companies furnishing asphalt will, if you request, supply bills of lading; we have contractors there now that we think are furnishing it.

MR. CLARK—And you do not know positively whether you receive land asphalt, or lake asphalt?

MR. HOLTON—We do not feel quite positive, but our bond is very severe and we require an affidavit in advance. We put all the safeguards around us that we can.

DISPOSAL OF GARBAGE.

By Thomas De Vilbiss, Chairman Board of Public Works of Ft. Wayne.

THE disposal of garbage embraces a consideration, first, of the method of collections, second, the character of vehicles, and third, the system by which it shall be destroyed.

The method of collecting garbage should be placed under direction of a competent department of the city administration, which should be empowered to provide ways and means, and adopt such rules and regulations as will compel the use by citizens of properly constructed water-tight metallic receptacles, which should be located at points conveniently accessible to the collector. In cities where coal is used as a fuel, ashes and all other refuse materials not incident to kitchen offals, should be kept separate from the garbage.

I am aware that a system which would be perfectly satisfactory to a city of the population and geographical location of the one I represent, might not meet the requirements of other cities. The methods by which garbage can be collected is largely a local question.

It has been my observation that where cities permit the work of collecting the garbage to be done by individual contract, that an avaricious and unscrupulous contractor will scheme to defeat the purpose of the contract, to enrich himself at the expense of sanitary conditions, which necessarily surround the disposal of garbage, and where the citizens have been permitted to employ local cartage, exorbitant prices have been demanded and the poorer classes compelled to live for days and weeks with the decaying matter surrounding them, unable to have the same removed.

It is, therefore, apparent that citizens, in their individual capacity, can not be relied upon to provide ways and means for the proper disposal of garbage, and this at once places the matter within the direction of the city administration and brings us to the question as to how a city official can best direct the collection of garbage.

Assuming that garbage should be lifted once in forty-eight hours, or every other day, and that the vehicle has a capacity of two cubic yards per load, and the distance to haul is not greater than one mile, and the population equal to about eight thousand people, it has been demonstrated that a district such as I have described can be kept clean and in a good healthful condition. Cities should be divided into districts, the area and population of which should not be greater than one man with a team can get over in two ordinary working days, allowing him to clean up at least one-

half of his territory each day, and thereby lifting the garbage once every forty-eight hours.

The bed of a vehicle or wagon, to contain the garbage, should be constructed of steel or iron and built water-tight, the lids fitting so as to avoid the emission of odors; the ends slanting so as to permit washing out and cleaning, and the general construction should be such that loading and unloading can be done promptly. Vehicles are being constructed with this end in view, and as the demand increases the character of the wagon required will prove equal to the demand.

The primary object in disposing of garbage is to prevent contagion and disease, and no system contemplating the disposal of garbage is complete unless that end can be reached.

In a number of cities the officials in charge of this matter have been induced to consent to the construction of immense plants for the purpose of reducing garbage, believing that the system of reduction is accompanied with economic results, and from the profits arising from the sale of the products they can, in time, be made self-sustaining; but it is my experience, after a careful investigation, that the primary object—namely: to prevent accumulation of filth and disease breeding conditions — can not be accomplished unless all matter and material to be found in the garbage box can be successfully incinerated and totally destroyed.

It is evident that the reducing process which offers marketable product for speculation is rapidly becoming a question of financial results, and an avenue for investment and speculation. The healthful condition of a community and the sanitary regulations to prevent contagion and disease, have become minor objects where the disposal of garbage is open to speculation. Therefore, the theory of a self-sustaining plant is erroneous, and must give way to a more practical and more certain method of meeting this demand upon the departments of city governments.

There are many other objections that could be urged against placing so serious a subject within the reach of speculators and capitalists, and there are sanitary reasons why a reducing process which do not destroy should not be encouraged.

The refuse matter necessary to be collected, comprises garbage, night soil and rubbish, and in many cities where the sewage sys-

tem is not sufficient, the destruction of night soil becomes a serious question. Plants constructed for the purpose of reducing garbage do not destroy this character of refuse matter, yet it is essential in order to have good sanitation that the system adopted for the purpose of disposing of garbage should include the destruction of all kinds of disease breeding materials or rubbish.

If the complete destruction of night soil can not be accomplished by operation of the reducing process, cities will be compelled to find other means of destruction, thereby causing the erection of a crematory for the purpose of consuming night soil, besides maintaining a reducing plant. This double expense can be avoided where a system is adopted that contemplates total destruction without regard to the marketable product that may be obtained through a reducing process.

JAMES. E. McGANN,
Third Vice-Pres. American Society Municipal Improvements.

If we keep steadily in view the primal object, and determine that the necessities of a city are sufficiently great to warrant rapid and complete disposal of garbage, we will readily reach the conclusion that the cremation of the same and its complete and thorough destruction by means of combustion will afford the remedy.

It may be urged that furnaces can not be constructed which will give entire satisfaction and completely destroy night soil, garbage, etc., without emitting offensive odors, to the annoyance of the people living within the vicinity of the crematory, but I hold that the question can be satisfactorily solved, and that the duty now devolves upon the administrative departments of our various cities to foster and encourage the development of garbage crematories, in order that, as the demand for the same may exist, that such devices may be constructed as will sooner or later overcome all objections urged against some of the present devices.

It can not be successfully urged against the crematory system, which totally destroys the garbage, that the expense of construction, collection and final disposal, is too great, nor can a comparison which can be successfully sustained be made to the disadvantage of cremation as between the two theories of consuming garbage, either

by the reducing process or its total annihilation by combustion, when we take into consideration the primal object for which these crematories are constructed and the benefits to be given to the people by the successful disposal of their garbage.

This can be accomplished through the operation of the administration boards, the expense of which should be paid out of the general fund, and the responsibility for the healthful condition of a city should be borne by the officers.

It has been my purpose, in what little I have said upon this subject, to establish a principle—namely, that the disposal of garbage is freighted with a high moral condition that can not be set aside for the purpose of creating revenues upon investments, but demands the scrupulous and honest efforts of municipal departments.

MR. BROWN—What furnace is used?

MR. DE VILBISS—We are constructing a Dixon furnace at the present time, but we have not yet had time to give it a practical test. There are several in the United States It is a furnace that destroys all kinds of garbage.

MR. BROWN—Does it require any extra fuel?

MR. DE VILBISS—Yes, sir; either coal or gas to start the fire. This is to dry out the garbage; after that operation it takes very little fuel. We think it will take a ton of coal a day.

MR. BROWN—For how much material?

MR. DE VILBISS—Well, our furnace consumes half a ton per hour.

MR. HESS—You make no effort at all to save any of the fats contained in the garbage by your system?

MR. DE VILBISS—No, sir; we burn everything.

MR. HESS—While the question of garbage is confronting all large municipalities, as well as small ones, on practical observation, it has been demonstrated that the total destruction of garbage by the crematory system is a willful waste of good material. When we speak of garbage we take in connection with that necessarily the dead animals of a community, and the value of that material, and that the disposal thereof should be made self-sustaining as near as possible. By practical observation it has been demonstrated that garbage as a whole, including dead animals, contains from six to seven per cent. of fat, which is saleable on the market at a profit of three and a quarter cents net, so that by taking a community of the size of Cincinnati or Cleveland, which I have the honor to represent, or Chicago, will furnish material which will certainly represent something of value. By the mere system of reduction, which is used in Buffalo, it has been demonstrated by the books of the concern, that the method is absolutely self-sustaining, and the bonus which the company gets there goes to the profit of the concern, thereby reducing the total expenses that the city would be at otherwise of furnishing a plant for destruction as well as the necessary contingent expenses for the operating of the same. Therefore it behooves every community to take into consideration the saving of the materials that come in the way of waste from the kitchen.

So far as the question of municipal collection of garbage is concerned, I think from what I have been able to learn that it would be rather an expensive method for cities to adopt, on account of the political complications that are likely to arise in connection with the same. A garbage plant that would employ say in the neighborhood of a hundred men, or one hundred and fifty, or two hundred, would necessarily become a part of the political machinery of the community, and it would be made subservient to political influences. It is much cheaper to let the work out by contract. It would certainly be a very expensive business in some of our large cities. I understand the city of Cincinnati has a garbage plant here which is giving very good satisfaction; their method of collecting garbage is placed in the department of public works, and so far they have not been able to arrive at any cost of collecting. The city of Buffalo pays $40,000 a year for the collection of garbage alone, and $30,000 for the disposition of it. The city of Cleveland has no system at all, except a primitive one, but we are very active and energetic at the present time, in the hope of securing one of the best methods, and to have it in operation by next spring.

MR. MUNRO, of Omaha—I would like to inquire of the gentleman if they separate the garbage from the ashes, and how they regulate that?

MR. DE VILBISS—In our community we have no way; we burn natural gas. The city can collect the garbage just as well as any company. We propose to divide our city into districts as soon as we have made a practical test of our crematory, so that one man, as stated in the paper, can go over a district and have the garbage collected every other day. We will advertise for bids and collect the garbage in the different districts, say two districts to one man. We will furnish our own wagons, because the wagons have a good deal to do with the sanitary conditions of collecting the garbage. Ashes properly are not garbage, and have nothing to do with the garbage.

MR. MUNRO—As the last speaker on the floor has advocated the contract system in preference to municipal control, I say, I think it is improper. We now, in Omaha, have the contract system and have seen its workings, and I must say as a representative of that city that we have found that it is not a success. The poor people of the city will manage to get rid of their garbage either by throwing it in the alleys or disposing of it in the night time some way to the detriment of the public, and it is impossible, no matter if you have a whole army of inspectors, to watch these districts, and to lay the blame on any one. After a trial of this system we have found it to be a failure, and the great majority of the people of Omaha would be in favor to-day, if the contract had expired, of going ahead under municipal control forever, so that it does not cost the individual anything but his taxes, and is paid from the general fund.

MR. HATHAWAY, of Mass.—I would like to hear from the chief engineer of the city of Buffalo. They have had a practical demonstration of the disposition of garbage for several years, and I understand they are in the front rank on this question, and I would like to hear from Chief Engineer Field.

MR. FIELD, of Buffalo—Mr. O'Shea is here and I think he can tell you more on the subject than I can.

MR. O'SHEA—I agree entirely with Dr. Hess, of Cleveland, in regard to the reduction system, as I think the trend of opinion of the people who have gone into this question seriously is towards the saving of all products that can be saved from garbage or kitchen offal, and this embraces, as he has stated, dead animals,

which, in most cities, are treated in connection with the garbage. In the city of Buffalo, the street department, of which I happen to have charge, at the present time looks after the ashes and garbage question, while the disposal of the animals is entirely in the hands of the health commissioner and they are treated at one of the rendering establishments immediately outside of the city. We have a contract at present for five years with Payne's Garbage Crematory for operating the Merz improved system. We have voted for that $35,000 a year and they treat all the garbage and kitchen offal of any description that we deliver at their works, which are located immediately beyond the city limits. They do not handle the carcasses of dead animals, but I understand have at present a question up with the health department with a view to taking this in. When they started their plant their facilities were not enough to take in horses and other animals. We handle the garbage entirely by the municipality; we have tried the contract system and we have voted it a very large failure. In reference to the political end of it, we do not believe that with proper municipal government there is any danger of politics creeping in.

We divided the city of Buffalo into eight districts, and the collections are made in each district entirely distinct and separate. We operate them just the same as if they had nothing to do with the general city government, as far as mixing them up in the management is concerned. The business district we collect from every night except Sunday, and in the residence district from the first of May to the first of November twice each week, and from the first of November to the first of May once each week. Our ordinance permits no garbage on the street. We try to minimize the odors and such offenses as will naturally come from the collection of garbage. The ashes, and all matter outside of garbage proper, is supposed to be collected in separate receptacles and is used for filling low lands in our city. We are at a disadvantage in reference to this disposition on account of not having at present very much low land to fill; we are rather in a flat country and our item of expense is large for the reason we are obliged to have long hauls in order to dispose of the material collected. This relates to garbage as well as ashes. Our crematory is located in the town of Cheektowga, and from the north end we have to haul a distance of eight miles. The minimum is, perhaps, two and a half. I think the gentleman who read the paper will find if he undertakes to make a collection on the basis of what one man and one team can do in a day, making his collection every forty-eight hours, that if his time is worth anything he will find that it will cost him a great deal of money, and that he better employ more men and get the value of his team; a team in Buffalo costs forty cents an hour and a man costs fifteen cents an hour.

Mr. De Vilbiss—We have our garbarge placed in the alleys very conveniently for the collection; it is placed in small cans made for the purpose of receiving the garbage, and all the collector has to do is to pick up the can and put it in his wagon and drive to the next place. We propose to collect all our garbage in our city with five teams; the total expense of collecting by our teams and our men will be $27 a day for a city of 40,000 inhabitants. I would like to know of the gentleman from Buffalo if there is any profit derived from the reducing process, who gets it? It certainly goes to the contractor; the city does not derive any profit from it, and you entirely lose sight of the sanitary question. The city should not be a party to the speculation.

Mr. O'Shea—I can not understand why the city is interested one way or an-

other. The primary interest of the city is the health of the community and the sanitary condition of the city, and if the system of reduction is the most desirable from the standpoint of the city, the fact that the company operating it may make some money, I do not think is pertinent at all. They are not in the business for their health, whether they run a crematory or a reduction system. If the reduction system can be operated, as far as the city is concerned, at less expense than the crematory, that is the only aspect that the city is interested in, always basing the initial step upon the sanitary condition. Now, whether the sanitary condition is arrived at through the crematory or the reduction system, I do not suppose you will find very many people who care.

MR. DE VILBISS—I would like to know what you do with the night soil?

MR. O'SHEA—We have very little of that. Our people have to have flushing closets. I do not think there are more than 150 vaults in Buffalo, and those are under the supervision of the Health Commissioner. The stuff is hauled out eight or ten miles beyond the city and given to farmers, who are very glad to get it for fertilization.

MR. DE VILBISS—I understand from the gentleman from Buffalo that his city pays $35,000 a year for reduction.

MR. O'SHEA—When we made the last contract with the Merz people, at Buffalo, we had propositions from the Simonen people and the Merz people. Our first bids were on the basis of destruction, we to pay so much for every ton destroyed. The Simonen people offered to build a furnace and destroy the garbage that is delivered by the city to the furnace for so much a ton on a lump sum basis; they will build the furnace at an expense guaranteed not to exceed a thousand dollars per ton capacity, they will lease that from the city for a nominal sum—a hundred dollars—and they will destroy all the garbage of the city for nothing and pay so much a ton; I believe, 20 cents a ton for all the garbage in sight. We did not believe we wanted to build any crematory or go into that phase of the business. We asked these people to tell us for what they would destroy the garbage of the city of Buffalo on a five-year contract. The lowest figure we could get was $35,000, and they had to build their own plant, operate it, and protect the city against any law suits for damages and nuisance. The plant is always under the supervision of the Health Commissioner and the State Board of Health. That is the best contract we could make from a business point of view. We do not want to go into the crematory business now. The other gentleman wants to go into that business. It is the same as municipal lighting—one city wants it for itself and another doesn't; there is no ironclad rule laid down; every man thinks for himself and every community for itself.

MR. HERRMANN—Do I understand you to say that your contract is for five years?

MR. O'SHEA—Yes, sir.

MR. HERRMANN—And at $35,000 per annum?

MR. O'SHEA—Yes, sir.

MR. HERRMANN—And that includes the animal offal or simply the collection of the garbage?

MR. O'SHEA—We collect ourselves; it costs us $40,000 a year to collect the garbage.

MR. HERRMANN—Cincinnati also has a garbage contract; we do our own collecting here. The material is delivered at the foot of one of our principal streets,

probably from six to eight blocks west of this hotel. The garbage is then towed down the river some six or seven miles to the plant. Our contract runs for ten years on a sliding scale, and I think it runs from $15,000 to $17,000 per annum.

MR. O'SHEA—This is with the Simonen Company.

MR. HERRMANN—The Simonen process.

MR. O'SHEA—In Detroit the Merz Company collects the garbage, and I believe their contract for collecting and disposing of it annually is $63,000. In St. Louis they have a Merz Company, also; I believe they had one in Milwaukee, and one in Chicago, which has been abandoned. They are trying two or three new furnaces there. In the city of Boston they have what appear to be very primitive methods; they collect their garbage under the charge of the street department in Boston, and I think they have five yards where the garbage is separated and the best portion of it is sold to the farmers in the surrounding suburban country and the balance of it is taken to the sea and dumped. They have had complaints from the city of Gloucester and all along the coast about the refuse being washed onto the shore, the same as the city of New York has had and the health commissioner there, I believe, stated that the deaths from typhoid fever on account of the feeding of garbage to the cattle in the surrounding Boston country was something that could not be determined. They have been advocating very strongly some system of disposition; they have tried two or three of the Dixon furnaces that the gentlemen from Indiana has decided to use. I think in Boston they have tried four systems, and they have not decided that they have a good one yet. In Glasgow, Scotland, they have immense plants, that cost them, if I recollect right, something like $400,000; they separate their ashes from the garbage; they run that through machinery, and the bones and glass and everything of that kind they take out and sell; the cinders they separate, and get sufficient fuel from to run all their boilers and engines; the balance of it, the fine dust, I presume, they mix with the soil and sell it to the farmers. They also have a farm of some thousand acres that they are reclaiming and operating for the municipality.

MR. KERR—Referring to Chicago, I desire to say that I have taken some time this summer in looking up this question as commissioner of the health department of that city, and the further one goes into it the further away they seem to get. We have a problem confronting us of 6,700 tons of garbage in a day; it has become one that must be settled, and we are very seriously considering it. It has been truly said that Glasgow stands first in that regard. The reason for that, to my mind, is that Glasgow is under what may be termed civil service rule. (Applause.) Chicago, desiring to lead in that matter, as in all others, has put itself under civil service rule, and, therefore, we have no fear of politics entering into the question of the disposition of garbage. The question has been considered by a commission appointed by the mayor of New York, and the report of that commission gives histories, or descriptions, of the various crematories, both reduction and destruction, but they make no recommendation of any kind. I think that this is one of the most important subjects that this body can consider in the near future, and I therefore call upon the secretary to read the resolution which I offer.

THE SECRETARY (reading)—"Resolved that a special committee of three of this body be appointed by the chair, whose duty it shall be to investigate and report at the next annual meeting, the best and most practical method for the disposition of garbage in cities."

The resolution was adopted unanimously.

EXPERIENCE IN SEVERAL CITIES WITH BRICK PAVING.

MR. VAN PUYNE, of the board of public works, of Newark, N. J., read a short paper on street paving, relating mainly to experience in his own city. He said that contracts are now out for a little over a million dollars' worth of paving in Newark, divided as follows: Oblong block, either granite or trap, nine miles; asphalt, seven and one-half miles; vitrified brick, two miles. He said: "Before deciding to put down any brick we visited several cities where this kind of pavement seemed to give satisfaction. However, when we were considering the ordinances, the opponents of brick brought many photographs of brick-paved streets that certainly did not look very promising. But we also remembered seeing photographs of streets paved with asphalt and granite that were anything but flattering to either of those pavements, and concluded to give brick a fair trial. It certainly is not affected by the extremes of heat or cold, nor is water detrimental to it, if the brick are properly made and selected. We are not attempting to have it take the place of granite but are placing it in side and resident streets more in competition with the asphalt we are laying.

D. L. FULTON,
Secretary American Society Municipal Improvements.

"All of our asphalt and brick paving is laid on a solid bed of concrete, six inches in depth, and most of the block pavement is laid in the same way. While we are laying considerable asphalt and also experimenting with vitrified brick, we have tried to emphasize the fact to our tax-payers that these improved pavements would not last like the old cobble-stone, or the substantial granite; that the smooth, almost noiseless and sanitary pavements came high, and, like all luxuries, needed constant attention and outlay.

"Other cities represented here may be interested in knowing the cost of these different pavements to us. They cost as follows: Oblong granite block, on sand, about $2.10 per square yard; on concrete, $3, with one year guarantee; on asphalt, about $2.70 per square

yard, and brick, about $2.15, with a five year guarantee. This price includes also the necessary grading in each case, but not the curbing.

"I have endeavored briefly to state my opinion of the different standard pavements, founded upon my observation of and experience with them, and now submit the subject to the consideration of the convention."

MR. HATHAWAY, of Marietta—I think through all this western country, especially outside of the large cities, where the traffic is very heavy, that you will find that the brick pavements are the most popular. We were doubtful, at first, in our city—like they are everywhere—about experiments with bricks, and so we called for bids and received a large number of specimens of vitrified brick, both shale and fire-clay, and after examining the samples and reading the different tests that were exhibited to us, we decided, living in a shale country, where shale was plentiful, that we would use shale brick. Our first brick were not repressed. There comes the question of what you will take, whether standard repressed brick, or what is called the block, which is larger. A beveled edge gives it a great advantage and makes a brick that will last longer. The main question, it seems to me, is to have the brick properly burned. If you can get the manufacturer to be interested with you and to burn the brick to the proper point (and it requires an expert to do it), then you will have a brick that will last, and there is no telling how long it will last. In regard to the burning, the manufacturers that have been using the old-fashioned kiln are loath to abandon it, because it costs them considerable money to change to the down-draft kiln; but you can not get a large number of bricks in the old-fashioned kiln, because they will get all out of shape and the hardest brick are always in the bottom. In the down-draft kiln the hardest brick are always in the top and they get a perfect shape, and you get from eighty to ninety per cent. of good brick out of such a kiln.

MR. HARPER, of Akron—I have not only been interested in the city work, but I have had to do with the manufacture of brick for a number of years. Mr. Hathaway has referred to the properly burned brick. Now, gentlemen, do not let the idea get any more prevalent than it is to-day that a paving brick must be extremely hard and nothing more; the qualities you want are toughness and tenacity, and the only way known to the brickmakers to-day to get those qualities in shale or in fire-clay is by annealing, on the same principle that steel was originally annealed.

MR. J. H. HALL, of Peoria—We have had a great deal of experience in Peoria in the laying of brick pavements, and are as a rule in favor of the small brick in preference to any other. In the mode of laying them we tried a bed of gravel on a thoroughly rolled sub-base, and then a cushion of two inches of fine sand. We have abandoned it for the reason that when the wet weather comes the water percolates through the brick and sand down into the gravel and you have an uneven surface. It will not settle uniformly, and for that reason we have abandoned the gravel and have substituted a six-inch concrete base with a two-inch sand cushion.

MR. BAURER, of Mansfield, O.—We have had an abundance of experience with brick, and I am sorry that I have not heard more in regard to the necessary foundation on which to lay brick. We have experimented with different foundations

and with different brick, and we find that no brick, whatever be its reputation as a lasting pavement, will stand for any time in a city of our size with less than three feet of a foundation; that foundation should be well drained, with large stones in the bottom, gradually coming up to six inches and then gravel. We have one street in our city paved with the common domestic brick, taken out of the old fashioned kiln, that has now been in constant use on a thoroughly traveled street for more than nine years and is in fairly good condition. We have our principal business street, with a very abrupt, steep grade, paved with vitrified brick, as it is called, but that is only a name; any brick can be vitrified by pouring salt in the kiln, but it is the clay that makes the brick. Our principal street for five years has been paved with that and it has given universal satisfaction. The wear and tear on that street to-day is almost imperceptible. Therefore, I would suggest that while you are making a beautiful street, be that street asphalt or granite, look to it, also, that you make a beautiful foundation for it.

STREET-CLEANING METHODS.

Mr. John Jones, street commissioner of Toronto, Canada, explained to the Society the street-cleaning methods of his city. He said: "Last year we cleaned 1,434 miles, lineal, of streets, the cost per mile averaging $22.76. This figure does not include the cost of cleaning asphalt pavements. The total spent in street cleaning proper, outside of the amounts expended on the asphalted streets, and the removal of accumulations of snow from crossings, bridges, etc., was a little over $32,500. The work is done by rotary sweepers, chiefly during the night, excepting the asphalt, which, for the period extending from May to December in each year, is cleaned by the orderly system; each man having an allotment of about one-quarter mile of street area; the balance of the year these pavements are cleaned with the rotary brooms, in common with the rest. Altogether we have eight machine brooms, all filled with steel fiber. Four of these are in constant use, the others being added as occasion demands. I have recently put two self-lifting machines in commission, which follow the windrows thrown up by the brooms, depositing the dirt in carts. I have every reason to be satisfied with their performance, both from the standpoint of economy and efficiency."

John L. Kennedy,
Treasurer American Society
Municipal Improvements.

MR. ADAMS, of Newark, N. J.—You do not wash your asphalt pavements.

MR. JONES—No; it would be too expensive in our city, as we have to pump all our water.

MR. ADAMS—I have recommended to our city not to water the asphalt.

MR. BROWN, of Indianapolis—There are some figures that may be of interest in the last bids we received for the sweeping of some of our streets. We have two classes of sweepers. One is the ordinary broom sweeper, and the other is a pneumatic sweeper which takes up the dust by the action of the current of air. We have also two classes of streets, the brick and the asphalt, and I have figures here for asphalt streets which are paved entirely across and for those which are paved only to the street car track, the track being left for the street car company to take care of. With the pneumatic sweeper we have in these last contracts the brick swept for forty-three and forty-six cents per ten thousand square feet surface, and the asphalt for thirty-nine to forty-two cents per ten thousand feet where it is paved across, and fifty-two cents where the street car tracks are not paved. The difference is largely because the cost is figured on the area of the asphalt, while the contractor is required to keep the dust down on the street car tracks as well as on the paved portion. The last bids which the company using the broom sweepers made are for the brick streets, forty-five and fifty-five cents per ten thousand square feet; for the asphalt, thirty-eight and thirty-nine cents, and where the street is paved across, fifty and fifty-two cents.

MR. O'SHEA—I would like to ask the gentleman what has been his experience with the pneumatic sweeper. Is it a Furnas sweeper?

MR. BROWN—We have the Furnas sweeper in our city and we find that it does better work than the broom sweepers. We have broom sweepers with hard brushes, and they are not entirely satisfactory.

MR. O'SHEA—What do you use in the brooms?

MR. BROWN—We use stiff rattan.

MR. O'SHEA—What does your pneumatic sweeper do when the pavement is wet?

MR. BROWN—We can not use it very well when the pavement is wet.

MR. O'SHEA—Do you think it is desirable to use a contrivance that you can not clean the pavement every day with?

MR. BROWN—We can not do much better with the broom sweeper.

MR. O'SHEA—Can you use the Furnas sweeper before your street is absolutely dry?

MR. BROWN—Yes, we can use it when it is wet, and while you water it, but it does not take any more than a few hours to dry in the center.

MR. O'SHEA—Mr. Jones, of Toronto, I think, stands alone among the men in charge of street work in America as being a successful user of steel. I do not know of any other man in the country that has been successful in the use of it, and Mr. Jones, of Toronto, seems to have the facility of getting the proper temperature. The rest who have tried never seemed to strike it right.

Mr. Harold P. Brown, city electrician of Newark, N. J., read a very interesting paper on electrolysis, which will be published hereafter.

ATTENDANCE AT THE MEETING.

BELOW is a list of the persons who attended the meeting of the American Society of Municipal Improvements:

Akron, O.—E. R. Harper, mayor.

Allegheny, Pa.—William G. Wilkins, bureau of engineering and surveys; David L. Fulton, superintendent of highways.

Bloomington, Ill.—W. P. Butler, city engineer; J. S. Neville, chairman improvement commission.

Bridgeport, Conn.—Frank W. Beers, board of public works; Frank E. Clark, mayor.

Brooklyn, N. Y.—Nelson P. Lewis, engineer of local improvements.

Buffalo, N. Y.—Samuel J. Fields, chief engineer; John S. O'Shea, superintendent of streets; J. Henry Wood, editor of *Municipality and County*.

Burlington, Iowa—William Steyh, city engineer.

Camden, N. J.—John Blowe, street commissioner; Charles P. Sayers, chairman street commission; L. E. Farnham, city engineer.

Chicago, Ill.—W. D. Kent, commissioner of public works; William R. Kerr, commissioner of health; L. B. Jackson, city engineer; G. L. Clausen, superintendent bureau of sewers: H. D. Patton, city sealer.

Chillicothe, O.—C. C. Waddle, mayor; George E. Mosher, city clerk; S. E. Mosher, president council; Edward Kern, vice-president council; C. E. Tippett, E. V. Stine, James A. Dumont and A. Stratemeyer, councilmen; H. M. Redd, city engineer; John W. Ogden, chief of police; D. C. Rinehart, chief of fire department.

Cleveland, O.—Dr. J. L. Hess, health officer; D. E. Wright, director public works; W. K. Ricksecker, superintendent infirmary.

Columbus, O.—Jerry P. Bliss, board of public improvements; A. H McAlpin, superintendent of water-works; H. W. Williams, director of public safety; Henry Hemmiller, chief of fire department.

Concord, N. H.—W. B. Howe, city engineer; Alfred Clark, commissioner of highways.

Covington, Ky.—Joseph H. Rhinock, mayor; W. S Rowland, president of council; T. H. Kennedy, city engineer; J. H. Fedders, superintendent of public works; W. H. Glore, superintendent of water-works; Joseph Meyers, chief of fire department; John A. Goodson, chief of police.

Davenport, Iowa—E. W. Boynton, commissioner of public works.

Dayton, O.—Charles E. Rowe, secretary of water-works; F. M. Turner, city engineer; C. G. McMillan, mayor; Peter Weidner, board of city affairs; O E. Davidson, board of city affairs; E. F. Pryor, president fire commissioners; B. B. Childs, J. Linzweiler, Jr., and R. T. McGregor, trustees of water-works.

Dubuque, Iowa—W. H. Knowlton, city engineer.

Fort Wayne, Ind.—Thomas D. DeVilbiss and Levi Griffith, board of public works; R. B. Rossington, board of public safety; B. F. Nind, city attorney; F. M. Randall, city engineer; W. T. Jefferies, city clerk; Charles H. Walpemath, H. Hied, and B. Borkenstein, councilmen.

Grand Rapids, Mich.—F Litchler, J. J. McBean, and L. C. Stowe, board of public works; H. A. Collar, city engineer.

Hamilton, O.—L. A. Dillon, city engineer; C. S. Bosch, mayor.

Harrisburg, Pa.—John McConkey, highway commissioner.

Indianapolis—Charles C. Brown, city engineer; William Fortune, C. O. Roemler, PAVING AND MUNICIPAL ENGINEERING; George R. Boyce, assistant city engineer; John H. Langdon and Lewis A. Langdon, Indianapolis Water Company; W. B. Holton, president board public works.

Lima, O.—R. H. Gamble, city engineer; J. B. Smiley, mayor.

Ludlow, Ky.—Walter T. Ritchie, city attorney.

Mansfield, O.—R. B. McCorry, mayor; H. A. Sloan, president of council; T. R. Robinson, city solicitor; F. M. Remy, city clerk.

Marietta, O.—E. Frank Gates, city engineer; S. J. Hathaway, councilman.

Milwaukee, Wis.—G. H. Benzenberg, president board of public works; E. M. Schuengel, S. Brockman and Fred Schneider, members board of public works; John C. Koch, mayor; James Bannen.

Minneapolis, Minn.—F. W. Cappelen, city engineer.

Mobile, Ala.—A. B. Roulston, mayor's clerk.

Nashville, Tenn.—John L. Kennedy, board of public works; A. W. S. Lindsley, chairman city and state development.

New Bedford, Mass.—S. C. Hathaway and Charles G. Brighton, board of public works; C. F. Lawton, superintendent public works; W. F. Williams, city engineer.

New Haven, Conn.—C. W. Kelley, city engineer; George L. Ives, superintendent of streets; Lyman H. Johnson, president board of public works; James Bishop, James N. States, James E. McGann and Nathan B. Hoyt, commissioners board of public works.

New York City—George H. Clinghan, The Engineering Record; G. H. Frost.

Newark, N. J.—Abram Joralemon, commmissioner public works; Harrison Van Duyne, president street and water commissioners; Henry E. Bailey and John J. Burckhardt, commissioners of public works; A. M. Linnett, clerk public works; Ernst Adam, city engineer; Harold P. Brown, electrical engineer.

Newport, Ky.—M. J. Costigan, city clerk; W. L. Glazier, city engineer; John Surran, superintendent of water-works; John DeBere, superintendent of public works; John L. Pythian, health officer.

Norwood, O.—J. M. Harper, city engineer.

Omaha, Neb.—G. F. Monroe, chairman public works; F. J. Kasper, member public works board.

Oswego, N. Y.—F. J. O'Brien, superintendent public works.

Parkersburg, W. Va.—R. H. Thomas, mayor.

Peoria, Ill.—A. D. Thompson, city engineer; Will O'Clark, commissioner of public works; J. H. Hall, mayor *pro tem.*

Piqua, O.—James Ward Keyt, mayor; H. E. Whitlock, city engineer.

Portland, Me.—George N. Fernald, city engineer; A. W. Smith, secretary park commission.

Richmond, Ind.—Joseph C. Ratliff, board of park commissioners.

Saginaw, Mich.—Robert H. Johnson, city clerk; R. W. Roberts, city engineer.

St. Louis, Mo.—R. E. McMath president board of public improvements; Frank L. Ridgely, park commissioner.

St. Paul, Minn.—L. W. Rundlett, city engineer.

Syracuse, N. Y.—Henry Collar, president common council.

Toledo, O.—Guy G. Major, mayor; C. E. Wall, chief of fire department; T. R. Cook, superintendent water-works; C. S. Brown, water commissioner.

Toronto, Ont.—William Burns and Robert H. Graham, aldermen; John Jones, street commissioner; John Blevins, city clerk.

Washington, D. C.—L. H. Beach, captain of engineers, U. S. Army.

Williamsport, Pa.—George D. Snyder, city engineer.

Youngstown, O.—F. M. Lillie, city engineer; F. G. McConnell, city commissioner.

CURRENT INFORMATION.

INFORMATION ON CEMENT.

Beginning with the November number, articles on the use of cement will be made a regular feature of PAVING AND MUNICIPAL ENGINEERING. We have made arrangements for regular contributions from Mr. L. C. Sabin, of the United States corps of engineers, a cement expert and a civil engineer of high standing. In addition to current and technical information, questions relating to cement will be answered, and particular attention will be given to cement tests. As nearly all our readers are directly interested in this subject, and many of them are large users of cement in various kinds of municipal work, we are well assured in advance of appreciation of this latest feature of improvement in this magazine. We hope to have the co-operation and assistance of all interested persons in making the new feature of the greatest possible value.

THE NEW YORK ROAD INQUIRY.

When the committee on roads representing the New York assembly recently visited Rochester they were addressed at length by Mr. John A. C. Wright, of the advisory committee of the national road conference, who is widely known as one of the leaders in this movement. He expressed opposition to national aid in road building, and said that he believed the solution of the problem was along the line of state, county and township action. State aid should be the first step. That should include a central bureau and engineering authority for the furnishing of information and advice. He referred to the proposed appropriation of $250,000 in New York, the tax for which would amount to only 5 cents on the $1,000. Of this but $17,500 would be paid by the owners of farm property each year, and in thirty years they would get 3,000 miles of good roads. He quoted figures showing the wastefulness of the present system. Wide tires were urged as a help in making and maintaining good roads.

A COURT DECISION DEFINING GRADING.

A court decision defining grading has been discovered by President McMath, of the board of public improvements, St. Louis, which removes a serious obstacle to a large class of street improvements. In a suit between private citizens, the court ruled that an 18-inch excavation on a street being prepared for a pavement was not grading, but "a mere preparation of the ground for the superstructure." Grading was defined by the court as "the establishing of a level, or inclination, as the case may be, as determined for the surfacing of the street. It may be done as well by filling above the natural surface as by digging below it." The board can now order the construction of a number of streets that could not be improved for perhaps

several years if the city had to pay for excavating the roadbeds. The entire cost of the improvement will hereafter be taxed against the owners of abutting property, except when the cost exceeds 25 per cent. of the value of the property, when the excess must be paid by the city.

GRADES OF ASPHALT STREETS IN NEW YORK.

The consulting engineer and water purveyor of New York City have taken exception to a report to the board of estimate and apportionment, questioning the paving with asphalt of streets on which the grade exceeds an inclination of 1½ per cent., on the ground that grades over this per cent. so paved were impassable for heavy trucks in winter. They mention ten or more streets which have been paved with asphalt where the grade varies from 2.5 to 6 per cent. One of these streets, with a 6 per cent. grade, was used in preference to parallel streets of less grade that were paved with stone blocks. Also, traffic has deserted Ninety-third street, paved with granite, and with 5.15 per cent. grade, for an asphaltic pavement with a 6 per cent. grade in Ninety-fourth street. The granite pavement on Fifth avenue between Thirty-fourth and Thirty-sixth streets, with 4.87 per cent. grade, has to be sanded for safety.

EXHIBIT OF ROAD MATERIALS AT ATLANTA.

General Roy Stone, special agent of the road engineering bureau of the United States department of agriculture, has sent out a letter announcing an exhibition of road materials and forms of construction, to be held under his charge at the Atlanta Exposition during the week of the Road Parliament, beginning October 17th. A series of scientific and popular traction tests will be made at that time. Samples of materials have been invited from the different states. These samples should be shipped in a nail keg, and should be marked "Roads, U. S. Department of Agriculture, Exposition Grounds, Atlanta, Ga." The government will pay the freight.

Mr. John A. C. Wright, the member for New York state of the advisory committee of the National Road Conference, and one of the leaders in the good roads movement, suggested that as the government paid the freight charge, it would be well to make some proper limitation on the specimens to be shipped. General Stone has accordingly requested that all persons, intending to send specimens, first communicate with the office of road inquiry at Washington, describing the character of the materials. The railroads have been instructed to receive only such parcels for shipment as are accompanied by a letter of approval from the department.

STATE LAW FOR THE PURCHASE OF ROAD ROLLERS.

An act passed by the last legislature in Massachusetts provides that when a town of not less than 10,000 inhabitants, or not less than two or more than five adjoining towns, whose combined population does not exceed 12,000, votes at a town meeting to expend not less than $3,000 per year each year for the term of five years, in the case of a single town, or $4,000 each year for the term of five years, when not less than two or more than five towns unite together, for macadamized roads, the commonwealth shall furnish, out of the state highway loan authorized by the act of the

present year, to such town or towns free of charge a steam roller of approved pattern and suitable size for the sole use of said town or towns during said five years and as long thereafter as they continue to expend this sum for macadamized roads each year.

Mr. Perkins, chairman of the state highway commissioners, says that the act does not meet the requirements. What the highway commission desired was that the state should be authorized to buy a number of steam rollers which would be at the disposal of the commission, to be used wherever they could be most advantageously throughout the state.

AN IMPROVEMENT IN ASPHALT PAVING ALONG STREET RAILWAY TRACKS.

A late improvement in street paving consists of placing the usual asphaltic pavement between the car tracks, by means of a steel girder rail attached to the tracks, allowing the wheels of the cars ample space, and obviating the necessity of using stone toothing which was laid for the purpose of allowing the wheels of the cars flange room. The adjustable girder rail is an angle bar bolted to the ordinary T rail, thus adding the girder to the center bearing rail. This protects the pavement from the wear into the flange space, and forms a perfect track. The steel girder is not worn to any extent by the action of the car wheels, and the asphalt in which it is imbedded is not disturbed. It is the invention of Mr. Blake, of F. O. Blake & Co.

A CITY CLAIMS EXEMPTION FROM COUNTY TAX LEVIES.

A suit has been brought at Michigan City, Ind., which will be of interest to property-owners in incorporated cities and towns in Indiana. The board of commissioners in LaPorte county made a levy of 8 cents on $100 for bridge purposes, and the tax-payers of Michigan City have filed suit in the superior court asking that this levy, in so far as it applies to the city, be set aside upon the ground that the city has exclusive jurisdiction over property within the city, and is, therefore, subject to no bridge tax levied by the county commissioners, and that no tax can be levied by the county commissioners upon city property for the purpose of building or repairing bridges outside the city limits.

SEWER ASSESSMENTS IN PENNSYLVANIA.

A decision has been handed down by the Pennsylvania Supreme Court which is of vast importance to both Pittsburg and Allegheny, and which affects every borough and municipality in Pennsylvania. For forty years the plan of assessing for main sewers on a water-shed basis has been in force, which gave general satisfaction, and was sustained by the courts in a number of instances. People having property abutting on the main sewers paid their proportionate share for the improvement; property-owners further back paid their share for drainage to the main sewer, and for lateral sewers. The plan was considered excellent in its equalization of the assessments made on properties benefited. The decission of the supreme court now is, that the cost of sewers can not be assessed on the water-shed basis. Only property abutting on the sewer or draining into it can be assessed. Such property, also, can only be made to pay to the extent it is specially benefited. The difference between the cost of the sewer and the benefits assessed on abut-

ting property must be paid by the city.

MAYOR PINGREE'S OBSERVATIONS ON PAVING.

Mayor Pingree, of Detroit, Mich., who visited several eastern cities in August, expresses himself as being greatly in favor of asphaltic paving since his return home. In an interview in the Detroit *Tribune* he says: "There's another thing the attention of the board of works ought to be called to, and that is the amount of asphalt pavement that is being laid in the east. In New York and Philadelphia they're putting down nothing else. I was driving down Fifth avenue the other day. That's paved with granite blocks, you know. Every little ways I noticed a strip of asphalt across the street in front of some hotel or club house. I found, after making some inquiries, that the proprietors had done it at their own expense to deaden the noise. It occurred to me that it would be a profitable thing for the business men on Gratiot avenue to do. You can have asphalt sheeting laid on granite blocks at a small expense, and if they had it on Gratiot avenue, the business men would not be obliged to take their customers out into the alley to escape the noise when they talked to them.

"The members of the board of works here are always telling how much trouble they have with asphalt paving. I notice that they don't have it in New York. I saw asphalt that had been laid six years and it was just as good as new. I was out on the Riverside drive the other day, and noticed that even the bridge approaches to the big viaduct were paved with asphalt. You won't find that any new cedar block paving is being laid in a single eastern city. The board of works here think cedar block is the best pavement on earth. It would pay the town to have those fellows learn something about asphalt. Then they'd know when it was well laid, and maybe they'd find out that it is the best pavement on earth."

FLOATING PAVEMENTS IN CHICAGO.

The *Chicago Record* says the recent rains in that city left West Madison street looking as if giants had been pelting each other. "Other west-side streets have much the same appearance. These streets are paved with cedar blocks, which swell with the rain and are forced upward by lateral pressure. In the rain-storm of yesterday and in those of the last week the whole pavement for blocks was raised in arches. When the streets dried up, the arches caved in and the blocks fell helter-skelter. Each succeeding rain floated them again and brought up large quantities of mud from below. This mud is distributed over the blocks that still keep their position, the others often being piled up in the street. Even between the rails the pavement has risen and heaved up into frequent piles. A few days ago the piles interfered with the cable cars so that the conductors had to get down and throw the blocks into the gutter. There they have lain—most of them—in little piles near the curb-stone.

PERSONALS.

E. C. Lewis, Mem. Am. Soc. C. E., Nashville, Tenn., has been made director-general of the Tennessee Centennial Exposition.

A. F. Harley has been elected city engineer by the board of public works at Jacksonville, Fla., to succeed L. H. Mattair, who resigned in June.

Maj. J. W. Howard was in Fort Worth and Austin, Texas, during September, where he was called as a consulting engineer in street construction and pavements.

Prof. Clifford Richardson, who has been absent from the United States during the last six months and but recently returned, calls attention to the fact that by mistake the authorship of the article on "California Asphalt and Bituminous Rock," in the Mineral Resources of the United States for 1893, and republished in this magazine in July, was attributed to him. A foot-note in the report which was inadvertently overlooked states that the technical features of the article and the matter relating to Trinidad asphaltum were prepared by Mr. Richardson, and the statistics of domestic productions were compiled and the text relating to the properties in the United States were prepared by Mr. E. W. Parker.

RECENT PAVING BRICK TESTS.

THE OFFICIAL TESTS IN NEWARK, NEW JERSEY.

To the Editor of Paving and Municipal Engineering:

I send you by this mail blue print showing the results of brick tests made for our lettings on August 29th, at which time four short streets were awarded, and for September 9th, when Roseville avenue was awarded for some 20,000 square yards.

Samples for these tests were required to be submitted for the first one by August 24th and for the second by September 5th. We had thirty-six samples for the first test and two additional makes, Nos. 37 and 38, were submitted for the second test, and in case the makes of brick which failed to pass the first test were again represented by samples, they were used in repeating that particular test in which the other samples had failed. This resulted in the retesting of about six samples of makes previously tested, and the adding of two more bricks to the acceptable list as marked in the table. I also send our blank form of brick specifications, in which you will find the requirements of test marked in blue.

The result of tests and the limits adopted proved very satisfactory in one way, which can be readily noticed, namely, that with the exception of the abrasion test, which, without doubt, is the most important test and the least likely to give unfair results, due to one faulty brick (two bricks being used in each case for this test, and the result being an average of the two). Only in one case was a make of brick thrown out for absorption alone, and also only in one case for modulus alone, showing that where brick was not up to requirements, it was as a rule deficient in more than one particular, thus minimizing the throwing out of a brick due to one faulty brick in the set of samples. Yours very truly,

M. R. Sherrerd,
Engineer Department Water.
Newark, N. J., Sept. 18.

The specifications referred to in Mr. Sherrerd's letter require that bricks and blocks must be capable of standing the following tests:

They shall not absorb more than three (3) per cent. of their own weight in water

after being broken and dried in an oven, and then immersed for 24 hours.

They shall not lose more than an average of eight (8) per cent. in an abrasion test conducted in the following manner, and under similar conditions as the tests heretofore made by the board: The bricks will be placed in a tumbler 21 inches in diameter, making from 43 to 45 revolutions per minute, and containing 150 pounds of rough scrap iron, a majority of the pieces weighing about one pound, and three pieces about 4 pounds each (it is intended in conducting this test to use the same scrap iron, with an additional weight sufficient to bring it up to 150 pounds, as was used in a comparative test heretofore made), the result in percentage lost being an average of the following three percentages:

First. The percentage lost in the first twenty minutes.

Second. The percentage lost in the second twenty minutes.

Third. The percentage lost in the above forty minutes.

Bricks and blocks will be placed separately in the tumbler. All bricks or blocks must give modulus of rupture of not less than 1800 when tested in their sides, being supported on knife edges six inches apart. The above coefficient to be calculated by the formula:

$$\text{Modulus} = \frac{3\,W\,L}{2\,A\,D}$$ in which W equals breaking weight at the center; L equals length between supports; A equals area section; D equals depth.

TESTS OF STREET PAVING BRICK IN NEWARK, N. J.—SAMPLES SUBMITTED AUGUST 24 AND SEPTEMBER 5, 1895.

Number.	Name.	Absorption.	Abrasion.	Modulus of Rupture.	Remarks.
1	Mack repressed shale brick	.028	.073	2143	
2	Mack fire-clay grooved block	.028	.080	2164	
3	Mack repressed fire-clay brick	.025	072	2470	
4	Mack wire-cut shale brick	.028	.088*	2111	Out acct. abrasion.
5	Mack fire-clay wire-cut brick	.028†	078	1966	
6	Mack repressed shale block	.022	.06	2822	
7	MacMahon, Porter & Co., wire-cut fire-clay brick	.028†	.067	2311	
8	MacMahon, Porter & Co., repressed brick	.039*	.086*	1510*	Out acct. absorption, abrasion and modulus.
9	Kountz Bros. & Co., wire-cut shale brick	.024	.105*	3623	Out acct. abrasion.
10	Brick Exchange, Canton, O., wire-cut shale brick	.026	.073	2065	
11	Catskill shale block	.027	.109*	1884	Out acct. abrasion.
12	American Fire-Clay Co., Toronto, O., wire-cut brick	.037*	.088	2568	Out acct. abrasion and absorption.
13	American Fire-Clay Co., Toronto, O., repressed brick	.023	.080	1838	
14	American Fire-Clay Co., Toronto, O., repressed block	.028	.100*	1551*	Out acct. abrasion and modulus.
15	Athens Brick Co., wire-cut shale brick	.046*	.113*	2268	Out acct. absorption and abrasion.
16	Athens Brick Co., shale block	.030	.112*	2132	Out acct. abrasion.
17	Minerva Paving Co., wire-cut fire-clay brick	.038*	.090*	1242*	Out acct. absorption, abrasion and modulus.
18	Minerva Paving Co., fire-clay block	.022	.127*	1691*	Out acct. abrasion and modulus.
19	Imperial block	.013	.077	2717	
20	Canton repressed shale brick	.009	.065	2604	
21	Imperial metropolitan block	.013	.056	2582	
22	Royal block, Canton, Ohio	.013	.053	2840	
23	Shale brick, Canton, Ohio. M. T. Dady	.011	.089*	1551	Out acct. abrasion and modulus.
24	Natural repressed shale brick, M. T. Dady	.057*	.119*	1370*	Out acct. absorption, abrasion and modulus.
25	Hocking block, M. T. Dady	.005	.067	2118	
26	Syracuse wire-cut brick	.000	.059	3912	Out acct. small size.
27	Clearfield brick	.015	.078	2139	
28	Clearfield block	.045*	.085*	2430	Out acct. absorption and abrasion.
29	Scranton repressed block	.015	.109*	2114	Out acct. abrasion.
30	Park Fire-Clay Co., wire-cut brick	.037*	.110*	1583*	Out acct. absorption, abrasion and modulus.
31	Park Fire-Clay Co, repressed brick	.041*	.094*	1412*	Out acct. absorption, abrasion and modulus.
32	Richardson, No. 1	.000	.067	2872	Name of manufacturer not given.
33	Richardson, No. 2	.022	.089*	1880	Out acct. abrasion.
34	Richardson, No. 3	.021	.086*	1694*	Out acct. abrasion and modulus.
35	Richardson, No. 4	.021	.102*	1948	Out acct. abrasion.
36	Richardson, No. 5	.049*	.069	1980	Out acct. absorption.
37	Johnsonburg shale brick	.009	.072	1735*	Out acct. modulus.
38	Campbell & Wood Ithaca brick	.007	.083*	2868	Out acct. abrasion.

*Adopted limits { Absorption, .030. Abrasion, .080. Modulus, 1800.

†Second test.

THE BOARD OF STREET AND WATER COMMISSIONERS, NEWARK, N. J.
Tests under direction of M. R. Sherrerd, Engineer.

CITY ENGINEER PFAFFLIN'S TESTS AT EVANSVILLE.

To the Editor of Paving and Municipal Engineering:

I send you, herewith, results of brick tests made by the board of public works of this city, August 22d and 23d, 1895. The rattler, 24x51 inches in size, turning 26 revolutions per minute:

	Abrasion Tests. Thirty Minutes.				Abrasion Tests. One Hour.				Absorption Tests. Forty-one Hours.			
	lbs.	oz.	lbs.	oz.	Per Ct. Loss.	lbs.	oz.	Per Ct. Loss.	lbs.	oz.	Per Ct. Gain
Scioto Block, two pieces	9	5	8	13	61	8	10	7.63	8	15½	0.51
do	9	2	8	8		8	6				
St. Louis Brick	6	2½	5	7	11.51	5	5	13.7	5	12½	1.04
									6	6	
St. Louis Block, two pieces	8	2	6	14	12.6	6	10	15.35	8	2	1.13
do	7	13	7	0		6	13		8	0	
Ironton Brick, two pieces	8	6½	7	10½	9.81	7	4½	13.70	8	8½	0.55
do	8	8	7	9		7	5		8	6½	
Lant & Morris, two pieces	6	13	6	4½	8.94	6	3	10.55	6	14½	1.15
do	6	18½	6	2		6	0½		6	14	
Ironton Block, two pieces	8	10	8	2	7.27	7	15½	10.54	8	15½	0.36
do	8	9	7	13		7	6½		8	12½	

Aug. Pfafflin, City Eng.

Evansville, Ind., Sept. 23.

TESTS AT JACKSONVILLE, FLA.

City Engineer Prioleau, of Jacksonville, Fla., reports the results of paving brick tests made under his supervision, as follows:

ABSORPTION TEST.

	Merit.		Percenatge in gain.
Chilhowie block	1		2.51
Mack block	4		4.29
Robbins paver	3	No. 1,	3.95
Robbins paver	2	No. 2,	2.86

ABRASION TEST.

	Order of merit.		Percentage lost.
Chilhowie brick	2		7.80
Mack block	3		7.97
Robbins paver	1	No. 1,	7.48
Robbins paver	4	No. 2,	9.92

CRUSHING TEST.

	Order of merit.	Crushed under weight per sq. inch.
Chilhowie	3	7,155 pounds
Mack	4	3,975 pounds
Robbins No. 1	1	9,540 pounds
Robbins No. 2	2	7,950 pounds

GENERAL AVERAGE.

	General average.	Order of merit.
Chilhowie	6	2
Mack	11	4
Robbins No. 1	5	1
Robbins No. 2	8	3

The following notes were made by the engineer in his report of the tests:

"Absorption Test—Samples were slowly tested to a temperature of about 1,000 degrees Fahrenheit, and allowed to cool slowly, after which they were submerged in water for twenty-four hours.

"Abrasion Test—The samples were placed in an iron cylinder, 5 feet long and 3 feet in diameter, together with 200 pounds of scrap iron, and taken out after 1,000 revolutions, the cylinder revolving at the rate of 11 revolutions per minute.

"Crushing Test—Two-inch cubes used in the test.

"If the cube of the Chilhowie block had been perfectly cut, thereby affording a better bearing surface to the faces of the rain, it probably would have stood a higher pressure in the crushing test."

LEGAL DECISIONS.

[Reported for PAVING AND MUNICIPAL ENGINEERING.]

Liability of City to Contractor.—The liability of a city to a contractor for the value of street improvements, imposed by the statutes, arises only when the city has issued and sold bonds to pay for such improvements, or has collected assessments made for that purpose against the property benefited. Where the street improvements were made under a contract, and ordinance providing that the cost of such improvements should be paid by assessments collected from the owners of abutting property, which assessments might be deferred, and bonds issued by the city to pay for the improvements, the petition of the contractor, alleging that a specific sum is due him for making such improvements, and that the city is about to issue bonds, shows no liability of the city for the sum claimed. Porter *v.* City of Tipton (Supreme Court of Indiana), 40 N. E. Rep. 802.

Notice of Defective Sidewalk.—In a suit against a borough to recover for personal injuries received on a defective sidewalk, where it appeared that, before the accident, the street commissioner examined the sidewalk, it was not error to charge that, if any defect then existed in the walk which was apparent to a person examining it with ordinary care, the borough had actual notice of such defects. Fee *v.* Borough of Columbus (Supreme Court of Pennsylvania), 31 At. Rep. 1076.

Record Necessary to Make Assessment Valid.—Under the statute, requiring the assessment, warrant, diagram and engineer's certificate to be recorded in the office of the superintendent of streets in order to render an assessment for street improvements a lien on the land, the engineer's certificate must be recorded as a part of the assessment record, and not in a separate book. Rauer *v.* Lowe (Supreme Court of California), 40 Pac. Rep. 337.

Evidence of Waste by City Officers.—If a city council, in bad faith, and as a matter of favoritism, grants franchises to a person for less than could be obtained from another, such act is within the statute authorizing tax-payers to sue city officers to prevent waste of city property. If such council granted franchises for a part only of the compensation which it was authorized to exact, without any endeavor to secure greater, and without giving any opportunity to competitors to bid for such franchises, a *prima facie* case of waste of municipal property is made. Adamson *v.* Nassau Electric R. Co. (Supreme Court, Special Term, Kings County), 33 N. Y. S. Rep. 732.

Right of Action Against Contractor.—A provision of a city charter that no action shall be maintained against the city for injuries caused by defective streets, unless notice of the claim shall have been given the city in writing within a certain time, does not affect the right to sue the person by whose act the street was rendered defective. Rider *v.* City of Mount Vernon (Supreme Court, General Term, Second Department), 33 N. Y. S. Rep. 745.

Vacation of Street.—The mere vacation of a public street does not involve the infringement of any private right. It is only a surrender or extinction of the public easement. United New Jersey R. & C. Co. *v.* Nat. Docks & N. J. Junction Connecting Railroad Co. (Supreme Court of New Jersey), 31 At. Rep. 981.

Defective Sidewalks.—A cross walk containing a loose plank, the end of which is raised about two inches above the level of the walk, is "reasonably safe," within the meaning of the statute, which makes it the duty of municipal corporations to keep cross walks in reasonably safe condition for public travel; and a person injured by stumbling against such plank can not recover. Weisse *v.* City of Detroit (Supreme Court of Michigan), 63 N. W. Rep. 423.

Validity of Assessment for Street Improvements.—A city charter provision that, when the city council shall determine to have street improvements made, the engineer shall report the probable cost, and give the names of those owning property on either side of the street, and the number of front feet owned by each party, is mandatory. If the legislature has power to authorize the city to lay the whole costs of improving streets on abutting property, that authority must be clearly given, and the mode strictly followed, or the assessment will be void. City of Dallas *v.* Ellison (Court of Civil Appeals of Texas), 30 S. W. Rep. 1128.

Effect of Change of Charter.—A contract for improving streets was let under a city ordinance, which did not levy any assessment to pay for the work or make any provisions for the time of payment. The city charter was repealed about the time the work was completed, and a new charter, without any saving clause in reference to executed contracts, was made, under which the whole of such an improvement, except the grading, was to be paid by the property owners, while only two-thirds of the improvements could be charged against them by the former charter. It was held that the abutting owners could not be taxed under the new act to pay for the improvements. City of Dallas *v.* Ellison (Court of Civil Appeals of Texas), 30 S. W. Rep. 1128.

Damages for Change of Grade.—Under the statute, which provides that when any city has established the grade of a street, and any person had made improvements thereon, and the city alters such grade to the injury of such property, the city shall respond in damages; the owner of a house built on an established grade, which was subsequently changed by the city, can recover for any injury, though the final grade is on a line with the natural surface of the street. Ressegieu *v.* City of Sioux City (Supreme Court of Iowa), 63 N. W. Rep. 184.

MACHINERY AND TRADE.

John Miller, Roslyn, Wash., is building a new brick plant.

Whitmore & Shaw, brick manufacturers at Suncook, N. H., have failed.

The Harmony Brick Co., of Brandt, N. Y., has been granted a charter.

It is claimed that Livermore Falls, Me., is a good opening for a brick plant.

Antwerp, N. Y., will have a vitrified brick and tile manufacturing establishment.

The Mt. Carmel Pressed Brick Works, Mt. Carmel, Pa., will be moved to Shamokin.

The purchase of a stone-crusher is contemplated by Antrim township, Greencastle, Pa.

P. Connor's excelsior works, Toronto, O., began running the first week in September.

A new steam drier is to be put in at the Eureka Brick, Tile, and Electric plant at Eureka, Ill.

The brick plant at the kaolin beds near Milwaukee, Wis., has been purchased by H. A. Bright.

Machinery is being placed in position in Smith Bros.' new brick manufacturing plant, at De Pere, Wis.

The Hastings Paving Co., Hastings, N. Y., has resumed operations, after a five-weeks' shutdown.

Capt. W. H. Moore, of Pittsburg, and Capt. Alex. Minno, of McKeesport, Pa., will erect a brick and tile manufacturing plant at Manown, above McKeesport. They will employ 700 men.

The Pitts Agricultural Works, Buffalo, N. Y., has sold a steam road roller to the common council of Marquette, Mich.

The Purington Paving Brick Company, Galesburg, Ill., recently shipped ten barrels of paving brick to Melbourne, Australia.

Theodore Martin and Ed. Miner, Astoria, Ill., who purchased the Lewiston Pressed Brick Factory, are looking for a new location.

Fred. W. Richart, Carbondale, Ill., is designing the top work, screening, and hoisting equipment, of 2,000 ton capacity, of a coal mine.

The business of W. Watkins & Co., Rooms 13 and 14, 177 La Salle street, Chicago, has been incorporated as the W. Watkins Company.

Gage & Legg, Jackson, Mich., have sold their brick yard in Summit to I. H. Clixby, of Detroit, and it will be known hereafter as the Jackson brick yard.

Chisholm, Boyd & White, of Chicago, have manufactured into brick a barrel of clay sent from Butternut, Wis., which makes an exceedingly fine, red brick.

James Hornsby, of Perth Amboy, N. J., contemplates establishing a manufacturing plant at Ogden, Utah, for making sewer pipe, brick, clay ornaments, etc.

The capital stock of the Monmouth Brick Co., Monmouth, Ill., will be increased to $12,000. Superintendent Wall, of Kewanna, Ind., has assumed the management of the plant. A new clay drier and two new kilns will be added during this winter.

The street commissioners of Binghamton, N. Y., recently granted to R. B. Truesdell the privilege of testing his street sweeper in Henry, Chenango and Lewis streets.

Shipments are being made to Oregon, Washington, San Francisco, Denver, and New York, by the Alcatraz Asphaltum Mining Company, at Carpenteria, Cal.

In a recent communication to the board of public works, at Omaha, Neb., Hugh Murphy stated that he would use Alcatraz asphalt in the paving of Sherman avenue.

Jerome Walsh, Hudson, N. Y., has discovered a large quantity of shale of a superior quality, at his brickyard at Stockport, and a shale brick manufacturing industry will be established.

The Jensen Vitrified Brick Co., with works at Russell, about four miles from Vancouver, Wash., has added about $11,000 worth of machinery to the plant and is turning out satisfactory brick.

The new plant of the Bucyrus Brick and Terra Cotta Co., Bucyrus, O., has been sold at sheriff's sale for $6,000. The property was bid off for the old stockholders, who will organize and resume business.

The works of the Fultonham Brick Co., Fultonham, O., will be enlarged. Superintendent Hoover has been advised to arrange at once for the erection of a new seven tunnel drier and three large kilns.

The Indiana Bridge Company, Muncie, Ind., will, within a short time, erect a foundry department to its plant for the manufacture of architectural iron work. A feature of the new department will be cast iron fronts for buildings.

A. Leonhard, president of the Columbian Brick Mfg. Co., St. Louis, has organized a company at Murphysboro, Ill., for the manufacture of vitrified brick. The plant will have a capacity of 30,000 brick per day. Operations will begin early in October.

Articles of incorporation have been filed by the Verona Water Co., whose business will be conducted at Verona, Salt Lake county, Utah. The company will construct, maintain and sell general water-works and water supply business. John M. Whittaker is president of the company.

W. T. Barton, of the Alcatraz Asphalt Co., San Francisco, Cal., has associated himself with John Dunfee, at Syracuse, N. Y., and has located a site for establishing a plant for the preparation of the asphalt for Fayette street, the contract for which was awarded to Mr. Dunfee.

New Incorporations: Port Huron Vitrified Brick Co., Port Huron, Mich.; Horseheads Brick Company, Geo. Brand and Louis Dahl, Elmira, and Richard D. Eisenhart, Oliver D. Eisenhart and Emil Schapel, Horseheads; Indiana Shale Brick Company, Indianapolis, Indiana; L'Anse Pressed Brick Co., Sault Ste. Marie, Mich.; Mexican Asphalt Co., Chicago, Ill.

The Rock Creek Natural Asphalt Company, a Topeka organization, was granted a charter September 18, to operate in Kansas. The directors are John Bradley, Charles Wilbur, I. N. Wheatley, Topeka; J. D. Kerby, Wakefield, and W. A. Dennis, of Marrinette. The company will mine and refine natural asphaltum in the Indian Territory, and construct pavements and walks.

A special committee, Messrs. Burke, Marquadt and Alderson, has been appointed at Wausau, Wis., to investigate the matter of purchasing a stone crusher. A detailed report will be made at the first meeting of the council in October.

A valuable bed of clay has been discovered on the farm of Judge J. T. Morrow, near Hopkinsville, Ky. Samples have been tested by Walter C. Mitchell, of Cincinnati, who made dry pressed brick from it pronouncing it the finest clay for red pressed brick he had ever seen, and that they will bring from $18 to $20 per thousand. Cincinnati parties are interested in the discovery, and a big plant will probably be established.

The establishment in Michigan City, Ind., of the new sand brick industry is claimed to mark a new era in the manufacture of brick of all kinds. The process to be utilized by the Sandstone Company is claimed to be very valuable, and the tests that have been made have proved entirely satisfactory. The plant is being constructed under the supervision of E. C. Brice, the patentee of the process. J. W. Penfield & Son, Willoughby, Ohio. has the contract for a brick machinery outfit. The output of the plant will include building stone, brick of various styles and sizes, paving stone brick, fire stone brick, vulcanite fire tubing, retorts, glass pots, crucibles, etc.

The Callanan Road Improvement Company has been incorporated with a capital stock of $100,000. The company will construct macadam and telford roads, pave streets with asphalt, brick, granite, stone or other material; build railroads, operate stone quarries, construct bridges, viaducts, sewers, and water-works, and deal in stone, brick and asphalt. The plant is located at South Bethlehem, N. Y. The directors are: Peter Callanan, South Bethlehem; John H. Briggs, Coeymans; Chas. D. Hammond, Albany; Peter Scharbauer, South Bethlehem; Myer Nussbaum, Albany.

IMPROVEMENT AND CONTRACTING NEWS

PAVING.

Some of the citizens of Bloomington, Ill., favor the construction of asphalt pavements in that city.

An ordinance has been passed at New Orleans, La., requiring contractors to pay city license before bidding.

The New York Central railroad company, Niagara Falls, N. Y., will pave the depot yard of the Falls-st. station with asphalt or brick.

The authorities at New Haven, Conn. will endeavor to enforce the city ordinance which prohibits the laying or relaying of brick sidewalks.

Representatives of the board of public works, with the city engineer of Jacksonville, Fla., visited Troy, N. Y. recently to inspect the street paving of that city.

The Hallwood block pavement in Cortland-ave., Syracuse, N. Y., is completed from Midland to South-ave. The rest of the street under contract will not be paved until next year.

The street department at Newport, R. I. is paving the crossings on macadamized streets with block pavement, with better results than that obtained with the old cobblestone pavement.

The mayor at Portland, Ore., will veto the ordinance for an asphaltic pavement on Burnside-st., which act will prevent paving the street under any similar ordinance for six months.

Joliet, Ill. has entered into a contract with Dolese & Shepard of Chicago, to macadamize Bluff-st., from McDonough-st. to Davidson's Quarry, as an experiment for the benefit of the city.

Street Superintendent Miller, Oakland, Cal., has decided to make a test of the section of the Vrooman act requiring property-oweners, after notice from the superintendent, to repair the roadway abutting upon all their property.

The common council at Dunkirk, N. Y., has adopted the same specifications for asphaltic paving that were in force last year, viz: six inches concrete, one inch binder, three and a half inches asphalt.

The new brick pavement on Third-st., Wilmington, Del., is that city's first experiment with a foundation wholly of concrete. Crushed stone foundations have been used heretofore, under brick, and have proved satisfactory.

Press reports from Milwaukee, Wis., state that there is entertained by the members of the common council a feeling that before any more asphalt contracts are awarded there should be at least one competitor allowed in the field.

Charles M. Crawford, secretary of the Hartford paving and construction company, Aldermen Andrews and Gunshanan, and Councilman Baxter of Hartford, visited Brooklyn, N. Y. Sept. 6 to inspect a section of sheet asphalt that is being laid.

The committee on streets, Lowell, Mass., visited several cities during the latter part of August for the purpose of inspecting bridges. The committee was impressed with the value of asphalt for bridge flooring and with vitrified brick as a street paving material.

An application was made recently to the commissioners, Washington, D. C., by Superintendent Claude of the Rock Creek railway company, to pave the roadbed of his road on Florida-ave. with gravel or granite block. The commissioners refused the request and directed that the roadbed be paved with asphalt blocks.

While on a recent visit to Utica, N. Y., Prof. S. Metzler of Dayton, O., examined an asphaltic pavement on one of the principal streets that was laid when he was a resident of the city eleven years ago, and he found it seemingly as good as when laid, wear having failed to make any perceptible impression on it.

The first street paving laid in Kansas City, Mo., was in 1883, and the material was cedar blocks on board foundation. Since then more than one hundred miles of streets have been paved; cedar blocks, which were laid from an economical standpoint, have been replaced with either granite blocks, brick or asphalt.

An experimental section of pavement is being laid on San Pablo-ave., between Thirty-sixth and Adeline-sts., Oakland, Cal. It is being laid by Col. J. T. Cochran, manager of the Oakland rock company. The pavement will be laid where traffic is heaviest, and where the material and the manner of laying it will be put to the severest test.

Fargo, N. D., is making an experiment with tamarack as a street paving material. It can be laid for one-third the cost of cedar, and paving experts express the opinion that the wood is more durable than cedar. The smaller western cities will watch the experiment with interest, as the cost of paving has retarded this improvement in many of them.

The circuit court at Findlay, O., has suspended Judge Schaufelberger's order, setting aside the temporary injunction restraining contractors Cuthbert and Stewart, defendants, from paving Lafayette, Waters and Adams-sts., in Tiffin, with brown granite brick. No paving will be done until another resolution declaring the necessity for paving these streets is adopted.

Harvey Linton, city engineer at Altoona, Pa., writes that the Barber asphalt paving company completed, Sept. 6, the construction of 819 square yards of asphaltic paving on Fourteenth-st., from Tenth to Eleventh-ave, and 760 square yards, in Tenth-st. alley, between Fourteenth and Fifteenth-sts. Standard B. was laid, four inches concrete and two inches of asphalt. Cost $2.58 per square yard.

To demonstate the excellence of asphaltic pavements, D. R. Hockridge, Marinette, Wis., has laid,without expense to the county, an asphalt pavement from the steps of the court house to the sidewalk in Hall-ave. Mr. Hockridge claims that this pavement can be laid at much less cost than cement; is more desirable and more easily repaired. He has laid about 3,000 feet of it about his own residence.

A large sum of money is on hand at Memphis, Tenn., for use in street improvements, but the council is divided on the manner in which it should be expended; some favor sewer construction, and others think paving is most needed. Petitions have been received from various property owners who ask for all classes of pavements. A meeting was called for Sept. 30 to decide upon some course of action.

When City Engineer Barnes's force took up the cedar block pavement recently at the intersection of Sixth and Topeka-aves., Topeka, Kas., to widen the park, they found that at least one-third of the blocks were completely rotted off, only the surface remaining intact. The city has 37,000 square yards of cedar block pavement, and City Engineer Barnes thinks that in a little while it will all have to be renewed.

The common council, New Haven, Conn. is divided against itself in reference to the distribution of the $500,000 appropriated for permanent pavements. The controversy arises over the kind of material to use, sheet asphalt or vitrified brick. A plan is being considered now in New Haven, suggested by the Register, of the mayor appointing a pavement commission composed of representative and practical business men, to take up and formulate plans for the work.

Mayor Kingsley, Rome, N. Y., has had a vitrified brick pavement constructed in front of his property in W. Dominick-st. The area covered by the new pavement is 168x22, and is the first brick pavement ever constructed in a public highway in Rome. Mayor Kingsley is much interested in improved streets, which he thinks should follow a system of sewers, and believes a practical object lesson will bring about a reformation along the lines he is laboring.

At a meeting of the state assembly committee on good roads, at Syracuse, N. Y., John O'Donnell, ex-state, railroad commissioner of Lowville, suggested "the construction of steel track roads, claiming that a horse would draw twenty times as much on a steel track as on a dirt road, and that the steel would only cost two-thirds as much as the macadam road; the center state roads could be built of steel track, while two hundred miles of macadam were being constructed."

Street Commissioner Milner, St. Louis, Mo., will condemn about eight miles of streets now paved with asphalt and wooden or cedar blocks. His object is to stop repairs on worn out streets. The streets will have to be resurfaced, if the street commissioner's plans carry, and asphalt and brick will be used. It is not thought, however, that the plans will be carried out. The pavements there have been down only ten or twelve years, and the cost of the work has been borne almost entirely by the owners of abutting property. The city's share for grading the asphalt streets was less than $20,000, while the interested property owners paid $525,000; the contractors kept them in repair for nine years, the time having expired last year, so that the city has not had to bear much expense in the way of repairs.

The commissioners of Washington, D. C., have under consideration a question affecting the width of the streets. For some time complaints have been received from different sources concerning the width of roadways, and Maj. Powell is anxious to have the board adopt a width which shall be a standard, and which will be strictly adhered to. His plan is to make the roadways all thirty-five feet wide. The subject will be finally determined upon when the board meets again.

The first proposals made to the city works department in Brooklyn, N. Y., for brick pavements were received about Sept. 4, although a small area was paved with brick by the park department a few weeks since in providing a new connection between the main driveway of the Eastern parkway and Bedford-ave. The bids are for pavements in Nevin-st. and McDonough-st. The results of these experiments will be awaited with interest, and if satisfactory, brick will be extensively used in Brooklyn.

CONTEMPLATED WORK.

An asphaltic pavement is being agitated for lower Niagara-st., Buffalo, N. Y.

An ordinance has been passed at Washington, Pa., for paving N. Wade-ave.

Orange-st., between Elm and Eld-sts., New Haven, Conn., will be paved with Pitch Lake asphalt.

A special election was held in Neenah, Wis., Sept. 11, which resulted in favor of paving Commercial-st.

Waukegan, Ill. has passed an ordinance for expending about $38,000 for paving State-st. with macadam.

A resolution has been adopted at Burlington, Ia., for curbing and paving with brick, Grand-st., east of Main.

Lion, Smith, Lamphere, Deer, East and West Sixth-sts., Dunkirk, N. Y., will be paved with Trinidad asphalt.

An expenditure of $50,000 has been authorized for paving with asphalt the upper end of Fifth-ave., opposite Central park, New York.

The town board of Hempstead, N. Y., has acted favorably upon five petitions asking for macadam roads in various parts of the town.

Specifications have been ordered prepared at Albany, N. Y., for paving S. Ferry, Arch, High and Swan-sts. and Clinton and Central-aves.

The town council of Conshohocken, Pa., has appropriated $5,000 for permanent street improvements in the First, Second, Third, Fourth and Fifth wards.

Final action has been taken in the resolutions for paving Alabama-st., from Ft. Wayne-ave. to Seventh-st., with asphalt at Indianapolis, Ind. Resolutions have also been passed for an asphaltic pavement in Liberty-st., from Washington to Massachusetts-ave.

A subscription is being raised among wheelmen at Nashville, Tenn., for the construction of an asphaltic bicycle road from the city to Glendale park.

A petition has been presented to the common council at Cohoes, N. Y., asking for a sheet asphalt pavement on Saratoga-st., from Mohawk to Main.

The abutting property owners on Hill-st., between Neil and Randolph, Champaign, Ill., have signed a petition asking the city council to pave that part of the street.

The street board, Hartford, Conn., has voted in favor of Trinidad lake sheet asphalt for Main-st., from Arch to Needham's Corner, and block asphalt for Atheneum-st.

The proprety owners on Myrtle-st., between Fourth and Eighth, Erie, Pa., have presented a petition to the common council asking for a Trinidad lake asphalt pavement.

The system of registration for city laborers will be given its first practical test in Baltimore, Md., if the city council authorizes the repaving of Aliceanna and Broadway-sts.

The property owners on S. Locust-st., between Jackson and Clay, Chillicothe, Mo., are agitating the question of replacing the macadam on that street with vitrified brick.

A resolution has been passed at Warren, O., declaring it necessary to pave Main-st., from Park-ave. to the river. Also to improve Robbins-ave. by putting in curbing and gutters.

Charles P. Chase, city engineer, Clinton, Ia., writes that Clinton county will spend from $7,000 to $10,000 on road improvements at once. Mr. Chase reports that the engineering business has improved rapidly lately in the West.

A petition has been received from the property-owners on State-st., from Main to Madison, Elkhart, Ind., asking that the thoroughfare be paved with such material as is deemed best by the council.

Permission has been granted the property-owners on W. Dominick-st., Rome, N. Y., to replace the cobblestone pavement with vitrified brick; also the squares at the intersection of James and Dominick-sts., and Washington and Dominick-sts.

Cement sidewalks are to be laid in Washington, D. C., under the provisions of the permit system as follows: In front of No. 225 C.-st. N. E.; east side of Connecticut-ave. to 100 feet north of Florida-ave.; in front of No. 1,206 Sixth-st. N. W.

If the proposed change in grade is effected on Broad-st. and West End-ave., which the city council at Nashville, Tenn., has in contemplation, these two streets will be paved with asphalt for about a mile in length, and will be from eighty to one hundred feet wide.

Ordinances have been passed at Trenton, N. J., for paving with vitrified brick Spring-st., from Willow to Prospect; Montgomery from Delaware and Raritan canal; W. Hanover from Warren to the Feeder bridge; W. State from Calhoun-st. to the Ewing township line.

The street board, Hartford, Conn., has reported in favor of paving Church-st., from Main to Spruce, with Trinidad Pitch lake asphalt, or other asphalt equal thereto in quality. A resolution was submitted with the report ordering the work done as soon as practicable.

Action will be taken by the common council, Albany, N. Y., Oct. 7, on the following ordinances: Paving with dimension granite blocks, Green-st., from Madison-ave. to Gansevoort-st.; Trinidad sheet asphalt, Yates-st., between Quail and Ontario, and Ontario-st., between Madison and Morris-sts.

CONTRACTS TO BE LET.

Bids are invited until Oct. 2, at Zanesville, O., for constructing sidewalks in sundry streets.

Bids will be received until Oct. 4, at Kansas City, Mo., for building second class stone sidewalks in sundry blocks.

Sealed proposals will be received until Oct. 14, at Crawfordsville, Ind., for grading Scott-st., from Water to Elm. Bond required.

Sealed proposals will be received until Oct. 4, at Cincinnati, O., for paving with brick Carrie-st., and Voss, Mahle and Long alleys.

Sealed proposals will be received at Cincinnati, O., until Oct. 5, for grading, curbing and paving Watson, Kirby and St. Clair alleys.

Bids will be received at Keokuk, Ia., until Oct. 7, for grading and guttering, and paving with macadam, Eleventh-st., from Main to High. Certified check $50.

Sealed proposals will be received at Pittsburg, Pa., until Oct. 7, for constructing artificial stone pavements for the high school building at Fifth-ave. and Miltenberger-st. Check $100.

Bids will be received at Kansas City, Mo., until Oct. 1, for paving Central-ave. from Sixth to Ninth-st. Cash deposit $200; curbing Sixth-st. from Park to Prospect-ave., and Twenty-eighth-st. from Locust to Holmes. Bond $200.

Sealed proposals will be received at Brooklyn, N. Y., until Oct. 2, for repaving with asphalt, Remsey, Decatur, Clark, Schermerhorn and Second-sts., and St. Marks, Putnam, and Sixth-ave.

Sealed proposals will be received until Oct. 7, at Albany, N. Y., for curbing and laying flag and brick sidewalks, and paving with dimension granite blocks, Canal-st., from Lexington-ave. to Robin-st.

Sealed proposals will be received until Oct. 5, Dubuque, Ia., for macadamizing S. Bluff-st., Southern-ave., Garfield-ave., alley east of Stafford-ave., and alley between Lincoln and Rohmberg-ave. Bond $200.

Bids are being advertised for paving in Detroit, Mich., as follows: Trumbull-ave., cedar on concrete Medina curb, 11,804 square yards; Miama-ave., cedar on concrete, Medina curb, 1,262 square yards; State-st., brick on concrete, Medina curb, 576 square yards.

Bids will be received until Oct. 2, at Elkhart, Ind., for constructing cement sidewalks, as follows: Bottom of walks shall be 3¼ inches thick, made of one part good imported Portland cement and six parts clear gravel; the top shall be ¾ inches thick, of 5-11 imported Portland cement and 6-11 clean fine grit sand.

Sealed proposals will be received until Oct. 7, at Van Wert, O., for grading and macadamizing Walnut and Market-sts., and curbing Market-st. with stone, from Gleason-ave. to Sycamore-st. Deposit or certified check 10 per cent. of estimated cost.

CONTRACTS AWARDED.

J. Conn was the only bidder, Sept. 10, for a cedar block pavement on concrete, on Macomb-st. at Detroit, Mich.

The contract for boulevarding and macadamizing Broadway, Winnipeg, Man., was awarded to J. J. Egan for $18,522.

V. D. Eichenlaub, Lancaster, Pa., has secured a contract to lay about 2,600 yards of brick pavement in New Castle, Pa.

The contract for brick paving in Iowa City, Ia., was awarded to William Horrabin of that city, at $1.04 per square yard.

R. T. Hallam & Sons, secured the contract at McDonald, Pa., for grading, curbing and paving with brick, at $1.43 per square yard.

The Bermudez asphalt paving company, Detroit, Mich., was awarded the contract for paving the Belle Isle bridge approach, for $3,178.45.

The contract for paving Second-st., from Pike to Yesler-ave., with brick at Seattle, Wash., was awarded to A. J. Baumgartner, at $2.18.

A. Brazos & Son of Middletown, Conn., secured the contract for constructing a telford road at Portland, Conn., at $1.90 per lineal foot.

The Fruin-Bambrick construction company, St. Louis, Mo., has been awarded contracts for improving a number of alleys in that city.

Whitmore, Rauber & Vicinus secured the contract for paving Dartmouth-st. with Hallwood block for $8,881.88, at Rochester, N. Y.

The contract for paving Twenty-second-ave., from Ocean parkway to Bensonhurst, Brooklyn, N. Y. was awarded to John Maley for $28,125.

The contract for paving Railroad-ave., White Plains, N. J., has been awarded to Costello & Neagle, Elmira, for $27,964. Vitrified brick will be used.

The Heman construction company, St. Louis, Mo., was awarded the contract for repaving Summit-ave. at East St. Louis, Ill. Wabash brick will be used.

The selectmen of Griswold, Conn., awarded the contract for the new stone road to Pachaug, to Roscoe A. Woodbury & Co. of Central Falls, R. I.

Hennessey & Cox secured the contract at St. Paul, Minn., Aug. 23, for paving Wabasha-st., from Third-st. to College, with asphalt, at $2.42 per square yard.

The contract for paving State-st., Auburn,N. Y., was awarded to S. C. & C. E. Adams of Auburn, at $1.97 per square yard. West Virginia brick will be used.

McConaghy & Bennett, Greensburg, Pa., secured paving contracts for seven streets, and William Adams of Pittsburg, five streets at Turtle Creek, Pa., Sept. 16.

The contract for the Market-st. paving in Jacksonville, Fla., was awarded to G. R. Foster, Jr., who represented the Chilhowie block, for $1.40 per square yard.

Charles Spinks & Son, Newport, Ky., secured the contract for paving with vitrified brick, Henry Clay-ave., from St. Charles-ave. to Victor-st., in New Orleans, La.

The Winona construction company was awarded the contract for macadamizing the road between the lake bridge and Woodlawn cemetery at Winona, Minn., for $22,000.

A. Behringer, Houston, Texas, has been awarded a contract for 7,000 square yards of asphaltic paving in New Orleans, La. The Uvalde rock asphalt of western Texas will be used.

The Brick and Tile paving company of Camden, N. J., has been awarded the contract for paving Union-st., between High and Wood, at Burlington, N. J., at $2.30 per square yard.

The Cromwell, Conn., selectmen have awarded to the Construction stone company of Bridgeport, Conn., the contract for constructing a telford roadway at $1.63 per lineal foot.

The contract for building four and a quarter miles of macadamized roadway at New Brighton, and Westfield, Staten Island, N. Y., was awarded to Martin Murray for about $70,000.

The district commissioners, Washington, D. C., awarded contracts for furnishing vitrified invert brick to the district to McMahan, Porter & Co., at fifty cents per lineal foot, and to John Robrecht at $15 per 1,000.

Paving contracts were awarded Sept. 9, at Newark, N. J., as follows: Fifteenth-ave., granite blocks, John F. Shanley, $2.12 per square yard; Roseville-ave., firebrick, Terrence McMannus, Newark, $2.15 per square yard.

W. J. Horgan of New York City was awarded the contract at Mt. Vernon, N. Y., for paving with vitrified brick, E. Lincoln-ave, from N. Third to Summit-ave., at $2.20 per square yard. Mack brick will be used.

H. A. Collar, city engineer at Grand Rapids, Mich., writes that paving contracts have been awarded as follows: Brick, Jefferson-ave., 594 feet long, $4,200; N. Spring-st., 250 feet, $1,800; Louis-st., 1,150 feet, $7,750.

The Western paving and supply company was awarded the contract for an asphaltic pavement on Michigan-st., from E. Water to Broadway, and on Broadway from Michigan to Wisconsin, Milwaukee, Wis., at $2.30 per square yard.

The Metropolitan paving and construction company of New York City, was awarded the contract for paving Washington-st. with asphalt at Schenectady, N. Y., at $2.69 per square yard for paving, and eighty-two cents per lineal foot for curbing.

Paving contracts have been awarded at Indianapolis, Ind., as follows: Asphalt, Market-st. from Alabama to East, Indiana Bermudez asphalt company, $7.99 per lineal foot with any curb but granite; brick, Kentucky-ave., from Missouri-st. to River-ave., Capital paving and construction company, $5.25 per lineal foot. Wabash brick and stratified curb will be used. Any curb but granite, Capital paving and construction company, $3.12 per lineal foot.

The contracts for repaving with vitrified brick, McDonough-st., from Marcy-ave. to Tompkins-st., and from Tompkins to Throop-ave. and Nevins-st., from Schermerhorn to Dean, Brooklyn, N. Y., were awarded to James F. Gillen, at $1.57 per square yard.

Contracts and bonds have been approved in Indianapolis, Ind., as follows: Paving Delaware-st., from Seventh to Tenth with asphalt, Western paving and supply company, bond $7,500; Market-st., from Alabama to East, Indiana Bermudez company, bond $7,000.

J. B. Campbell, city clerk at Chester, Pa., writes that the contract for paving Ninth-st. has been awarded to W. E. Rielly of that city, at $1.80 per square yard. About 5,000 square yards will be constructed. Savage repressed brick on a clay and sand foundation will be used.

The contract for paving W. Otterman-st., from Pennsylvania-ave. to the Ludwick borough line, Greensburg, Pa., was awarded to G. W. Good & Co. of Greensburg, as follows: Curbing 44 cents per lineal foot; grading, 25 cents per cubic foot; paving Mack & Park brick, $1.17 per square yard.

The common council, Yonkers, N. Y., has awarded contracts as follows: Constructing 10-inch macadam pavement on Central-ave., from Tuckahoe-road to Chrisfield-st., Daniel Cahill, $13,020; constructing 12-inch macadam pavement on Nepperhan-ave., from Lake to Nepperhan extension, Dougherty & Berrigan, $6,000; grading Odell-ave., from Warburton to North Broadway, Daniel Cahill, $14,220.

James Dean, commissioner of public works, Detroit, Mich., writes that contracts have been awarded during September as follows: Washington-ave., asphalt, Medina curb, Bermudez asphalt company, $27,429.10, or $$2.90 per square yard; Adelaide-st., cedar on concrete, Medina curb, Sheenan & Co., $4,936.88, or $1.21 per square yard; Macomb-st., cedar on concrete, Medina curb, John Conn, $637.11, or $1.26 per square yard.

The bids submitted at De Kalb, Ill., for grading, curbing and paving with brick a portion of Main-st., were as follows: Campbell & Dennis, Joliet, Ill., $22,964.10; Talbot paving company, Chicago, $20,520.50; Rockford construction company, Rockford, Ill., $17,637.50; Chicago paving and supply company, $17,810.10; J. B. Smith & Co., Chicago, $19,548.50; James Bairstow, Chicago, $17,4445.50; Lyons construction company, Lyons, Ia., $18,752.70.

The Barber asphalt company was awarded contracts in Newark, N. J., Aug. 29, as follows: Oliver-st., $2.67 per square yard; Scott-st., $2.65 per square yard; Emmett-st., $2.67 per square yard. Horner & Co, were awarded contracts for brick paving on four streets, as follows: Johnson-ave, Mack blocks, $2.22 per square yard; Prospect-st., fire brick, $2.27; Congress-st., Canton repressed shale, $2.26; S. Tenth-st., Canton shale standard, $2.12.

Paving contracts were awarded Aug. 29 in New York City, as follows: Regulating and improving Cathedral parkway, One-hundred-and-tenth-st., from Seventh to Ninth-ave., to F. B. Smith, $59,180; from Ninth-ave. to Riverside Drive, Warren-Scharf asphalt paving company, $75,-221.50; paving approach to Macomb's Dam bridge, F. B. Smith, $7,567.20; asphalt walks in Central park, Sicilian asphalt paving company $1,710 and $2,375; repairing walk to Morningside park, Sicilian asphalt paving company, $1,146; repairing walks in Riverside park, T. U. Voorman, $2,893.

S. P. Browne, secretary of the department of public works, Chicago, writes that the contract for asphaltic pavement on Wabash-st. was awarded to the Mexican asphalt company. The work is to be completed in three months; the company is to draw no money whatever from the city until six months after the completion of the work, and then such an amount as is deemed sufficient by the commissioner of public works after he decides the work is satisfactory, and this is exclusive of the regular 15 per cent. reserve. The company is to keep the street in repair for seven months after completion.

Contracts have been awarded for macadamizing the National road at Wheeling, W. Va., as follows: First mile, James & Monihan and Martin Loy, at $1.05; second mile, William Folmer, $1; third mile, Joseph Meyers, 90 cents; fourth mile, William Folmer, 93 cents; fifth mile, William Folmer, 90 cents; sixth mile, William Folmer, 74 cents; seventh mile, John Armstrong, 77 cents; eighth mile, John Armstrong, 70 cents; ninth mile, John Armstrong, 79 cents; tenth mile, John M. Clayton, 80 cents; eleventh mile, William G. Morrison, 94 cents; twenfth and thirteenth mile.s, Elzie E. Bowman, 93 cents.

The street comittee, Buffalo, N. Y., awarded contracts Sept. 5 as follows: Alexander-place, from Ferry to Dexter-st., German rock asphalt company, $5,699; Scott-st., from Main to Michigan, Barber asphalt company, $12,285; Alabama-st., brick, WiMilliam H. Kinch, $8,939; Davey-st., from William to Broadway, Barber asphalt paving company, $51,463. Favorable reports were also made for resurfacing with asphalt Eagle, between Pearl and Niagara; Kehr-st., from Fougeron to Urban; Ashland-ave., from Potomas to Forest-ave.; paving E. North-st., from Durrenberger-place to Herman-st.

The contracts for paving State-st. between Water and Market, and Fifth-st., between Railroad-ave. and Baldwin-st., Elmira, N. Y., have ben awarded to Costello & Neagle, at $2.91½ per square yard. Daniker granite block, White Haven, Pa., on concrete will be used. W. Second-st., between Main-st. and Railroad-ave. was awarded to Costello & Neagle at $2.17 per square yard. McMahon-Porter West Virginia block on concrete will be used. Ward, Clark & Hays secured the contract for a Medina stone pavement on a sand foundation on Exchange Place at$2.65 per square yard, and for United States paving brick on Market, between State-st. and Railroad-ave., at $1.42.

Paving contracts have been awarded at Milwaukee, Wis., as follows, Sept. 9; Broadway, from Wisconsin to Michigan, Trinidad asphalt on concrete, Western paving and supply company, $2.30 per square yard, and stone curbing, 43 cents per lineal foot; Michigan-st., from Broadway to E. Water, Trinidad asphalt on

concrete, $2.30 per square yard, and stone curbing, 43 cents per lineal foot; Sept. 3, Second-st., 1,110 square yards, granite block, William Forrestal, $2.45 per square yard, and 235 feet of stone curbing, 40 cents per lineal foot; stone curbing Twentieth-st., 1,184 lineal feet, William Gutknecht, 37 cents; Third-st., 2,287 lineal feet, Fred Vogt, 38 cents.

Bids received for paving Sept. 16, at Syracuse, N. Y., were as follows; Asphalt, Hanover square and Water-st., John Dunfee, $32,672.25; Bermudez paving company, $40,368.50; Trinidad asphalt paving company, $34,461.25; Warren-Scharf asphalt paving company, $42,077.75; G. D. Grannis, $42,278.25; Fruin-Bambrick construction company, $33,201.25; Syracuse improvement company, $43,028.50; vitrified brick, John Dunfee, $34,815.25; Homer & Co., $32,250.25; G. D. Grannis, $46,192; W. Onondaga-st., Trinidad asphalt, Fruin-Bambrick construction company, stone curb, $7,890.60, concrete curb, $7,362.60; Warren-Scharf asphalt company, stone curb, $10,093.60, concrete curb, $10,027.60; Syracuse improvement company, stone curb, $9,470.60, concrete curb, $9,404.60.

H. H. Filley, city engineer at Kansas City, Mo., reports the contracts awarded during September as follows: Sept. 10, alley between Sixth and Seventh, W. Williams, $422.94; Central, from Sixteenth to Seventeenth, $4,797.50; Troost, from Twelfth to Nineteenth, $24,630, and Troost, from Twenth-eighth to Thirty-first, $21,780, Barber asphalt company; sidewalks east side Highland, from Eleventh to Twelfth, O. T. Redman, $55. Sept. 13, Campbell, Sixteenth to Seventeenth, John Keating, $3,506.88; Flora, Nineteenth to Twenty-fifth, A. J. Armstrong, $7,652.36; southwest boulevard, from bridge to state line, John Mahoney, $10,168.25. Sept. 20, sidewalk, west side, Delaware, First toSecond, C. M. Cravens, $244; curb, Nineteenth, from Tracy to Olive, C. M. Cravens, $3,431; paving Harrison, from Eighth to Tenth, Barber asphalt paving company, $72,175; sidewalk, east side, Grand, from Eleventh to Twelfth, Kansas City stone sidewalk company, $144.

Competition in asphalt paving has been temportrily shut out at Allegheny, Pa., by the public works committee's action Sept. 10, when it called up some paving bids, laid over June 16, for the reason that the specifications called for Trinidad asphalt, while the Breckenridge asphalt paving company, which uses Kentucky asphalt, presented a lower bid than the other firms and maintained the position that has been taken, viz., that the Kentucky asphalt is inferior to the Trinidad product. The Breckenridge company offered to give bond in any sum that it would be as durable as the Trinidad. However, the bids were taken up without changing the specifications and the contracts awarded as follows: Sicilian asphalt company, Grant-ave., from North-ave. to Ridge-ave., $4,959; Juniata-st., from Allegheny to Beaver-ave., $27,581; Middle-st., from North-ave. to Avery-st., $15,364.27. The contract for repaving Lacock-st., from Madison-ave. to School-st. with Ligonier block, was awarded to Booth & Flinn for $20.71. This was first ordered paved with granite block, but was vetoed by Mayor Kennedy.

John McDonald, city clerk at Brazil, Ind., writes that contracts for paving have been awarded as follows: Sept. 20, Meridian-st., graded 12 inches, 4 inches of crushed stone or slag; 4 inches of gravel; 1 inch of sand; brick 2¼x4¼x8½, laid edgewise; curbed with stratified limestone 20x4 inches, Patrick Fitzpatrick, $1.76 per foot front. Washington-st., 300 feet long, $1.32 per foot front; foundation of ashes 7 inches in center and 3 inches at curb; 4 inches of crushed limestone; 3 inches of limestone screenings; 600 feet 3x20 curbing 600 lineal feet, 3x20 gutter; 30 foot roadway, 4 foot tree space and 6-foot sidewalk; cost about 65½ cents per square yard; awarded to Hawkin Hawkins. Kruzan-st. has ben recently improved, but the matter of putting limestone screenings on top of the crushed stone was overlooked or not understood at that time, as it was the first work of the kind that was done, but all tnat has to be done will be to rake up the stone from the gutters to the center of the street, then cover it with 3 inches of stone dust. The contract was awarded to Hawkin Hawkins at 14½ cents per foot each side.

SEWERS.

The East Side sewer, Rochester, N. Y., is practically completed. It is more than 8½ miles in length. Contracts for its construction were awarded in nine sections, in addition to which two storm over-flows have been constructed. Of the $1,000,000 appropriated for its constrution, there remains unexpended a little more than $100,000, but this balance will doubtless be used in completing the laterals for the accommodation of storm waters, which the main sewer cannot carry off during heavy rainfalls.

CONTRACTS AWARDED.

Gamble & Co. presented the lowest bid for sewer construction in Edgewood, Pa.

F. S. Koglin of Buffalo, was awarded the contract for laying a sewer at Avon, N. Y., for $7,931.71.

The system of sewers for Rockville, Conn., will be built by Chaffee, Lyons & Gamino of Providence, R. I.

The contract for sewer construction at Austin, Minn., was awarded to Martin & Goodwin of Austin, for $2,536.

Madlen & Fink, Goshen, Ind., secured the contract for constructing a sewer outlet at Valparaiso, Ind., for $3,708.20.

Fred. Youngren, Minneapolis, was awarded the contract for constructing sewers in Hillsboro, N. D., for $2,997.

K. A. Smith, Faribault, Minn., was awarded the contract for constructing 5⅛ miles of sewer in Madison, Wis., for $12,119.

The contract for erecting the sewer outlets at Pittston, Pa., was awarded to the Lindsay construction company for $3,747.45.

Stevens & Vincent, Chippewa Falls, Wis., secured the contract for constructing the asylum sewer and cess-pool in that city, for $3,147.

Contracts were awarded Sept. 17, at Newark, N. J., as follows: Constructing sewer in Bruce-st., Condon & Boyd, $699; S. Thirteenth-st., Murray & Hunkele, $356.90.

The board of public works at Rhinelander, Wis., awarded the contract for additions to the city sewer system to Jackson & Longton.

The contract for furnishing 22,000 sewer blocks to Baltimore, Md., was awarded to Shreve & Molinard at $2.15 per square yard, in the finished work.

P. H. Harrison & Sons, 145 Broadway, New York City, was awarded the contract for sewer construction in Mechanicsville, N. Y., for $29,003.10.

The contract for constructing the upper Main-st. sewer, Cooperstown, N. Y., has been awarded to J. Warren Lamb & Co. at 36 cents per lineal foot.

Contracts were awarded Sept. 20, at Pittsburg, Pa., for constructing about $100,000 worth of main sewers on the condition that the work must be completed this year.

John McDonald, city clerk at Brazil, Ind., writes that the contract for a twenty-four-inch vitrified pipe sewer was awarded Aug. 20 to Cutshall & Luce for $1.03 per foot.

The contract for a sewer on Fourth-st., between Ridge and Henry, Alton, Ill., has been awarded to David Ryan at 64 cents per lineal foot, $27 for catch basins and $26 for manholes.

T. H. Karr was awarded the contract, Sept. 20, at Troy, N. Y., for constructing a twelve and fifteen-inch pipe sewer in Seventeenth-st., from Hutton to Hoosick, at $1.29 per lineal foot.

The joint board of sewer commissioners of New Brighton and Port Richmond, N. Y., awarded the contract for the Jewett-ave. sewer to William J. Dowling of Port Richmond for $14,895.83.

Dowling & Maher was awarded the contract for building a sewer in Congress-ave., from the boulevard to West river, New Haven, Conn., for $7,170, and in Orchard-st. and Gilbert-ave., $3,380.

The contract for a sewer in Claremont-ave., from Munstain to Highland, Montclair, N. J., was awarded to Nicholas Cairo for $1,658.13; Gates-ave., from Hawthorne to Union-st., David DeOlds, $579.50.

The contract for constructing the "Pogue's run interceptor," Indianapolis, Ind., was awarded to M. M. Defrees at $4.65 per lineal foot; local sewer in alley east of Ash-st., Gansberg & Roney, $1.26 per lineal foot.

James Collins secured the contract for a sewer in E. Thirtieth-st., between Fourteenth and Fifteenth-aves., and Dunn & Cortes was awarded the contract for the Stout-st. sewer between Main and Holsman-sts., Paterson, N. J.

Sewer contracts have been awarded at Camden, N. J., as follows: Master-st., B. F. Sweeten & Son, $1.10 per lineal fooot; Senate-st., B. F. Sweeten & Son, $1.05 per lineal foot; Third-st., Aaron Ward, 91 cents per lineal foot.

Sewer contracts have been awarded at Wabash, Ind., as follows: Hill-st., from Thorne to Cass, Fisher, Kiefer & Bailey, $2.18 per lineal foot; Fisher-st., from Hill to Maple, Philip Hipskind, $2.08; alley north of Hill-st., Philip Hipskind, $1.98.

The contract for constructing a sewer in Yates-st., from Quail to Ontario, Albany, N. Y., was awarded to Edward F. Dillon for $1,027.30. Mr. Dillon was also awarded the contract for a sewer in Eagle-st., from Lancaster to Hudson-ave., for $558.28.

The contracts for sewers in Converse-ave., Palmer, Mass., and the street leading to the Athol depot, Three Rivers, have been awarded to John W. Brainard, as follows: Converse-ave., 35 cents per foot and five manholes at $25 each; Three Rivers, 68 cents per foot.

J. McCormick & Son was awarded the contract, at Erie, Pa., for a fifteen-inch tile sewer in Ninth-st., from Liberty, west, at $2 per foot for straight and curve pipe; $2.25 per foot for branch pipe, 58 cents for nine-inch pipe, 40 cents for six-inch connections, $50 for manholes and $38 for catch basins.

King & Son, Stockton, Cal., was awarded contracts in that city for sewer construction as follows: Weber-ave., from Grant to Stanislaus-sts., and Grant-st., from Weber-ave. to 110 feet north, $538.69; Weber-ave., from 95 feet west of Union-st. to 95 feet west of Pilgrim-st., $398.87.

J. B. Campbell, city clerk at Chester, Pa., writes that sewer contracts have been awarded as follows: Fourth-st., 700 feet, 2 feet brick, Hanna & Reilly, $1.42 per lineal foot; Penn-st., 60 feet, 18 inches, terra cotta, Hanna & Reilly, $1.25; Eighth-st., 700 feet, 2 feet brick, J. B. Helms, $1.47 per lineal foot.

The special committee of councils on sewage disposal, Altoona, Pa., awarded the contract Sept. 18, for the Fourth district sewer extension to Campbell & Dennis of Joliet, Ill., for $41,427.54. The sewer will be 15,180 feet long, of which 5,900 feet will be of brick, 3,163 feet of 36-inch pipe, and 6,116 feet of 27-inch pipe.

H. H. Filley, city engineer at Kansas City, Mo., reports that contracts have been awarded as follows: Sept. 9, sewers in districts, 42, 44 and 107, brick, 3 feet and 6 inches, 632 lineal feet at $3.10; 12-inch catch basin connections, 70 lineal feet 40 cents; 18-inch catch basin connections 180 lineal feet, 65 cents; three catch basins, $30; four manholes, $25; rock excavation, 150 cubic yards, 1 cent; concrete, 10 cubic yards, $3.50; lumber, $30; total $2,360.70. Awarded to Lillie & Glennon.

Harvey Linton, city engineer at Altoona, Pa., writes that sewer contracts were awarded Aug. 30 as follows: Fourth district sewer extension, Twenty-third-st., Bowman Bros. of McKeesport, Pa., 2,196 lineal feet of 24-inch pipe, $1.59; branches $2.50 each; Chestnut-ave., from Twenty-third to Twenty-fifth-st. William H. Herr, 340 feet of 10-inch and 430 feet of 8-inch pipe, Y branches and one air inlet, 60 cents per foot; Lexington-ave. from Fifth-st. to Third district, Matthew H. Smith, 590 feet 10-inch pipe with Y branches and one air inlet, 50 cents per feet, and 60 cents for 10-inch pipe, and $12 for an air inlet; Fourth-ave., First to Seventh-st., Isaac Bender, 2,207 feet 10-inch and 320 feet of 8-inch pipe, Y branches and two air inlets, 49 cents per foot; Third-ave. and two branches, Isaac Bender, 1,390 feet of 8-inch pipe with Y branches, and 1,390

feet of 10-inch pipe with Y branches and three air inlets, 43 cents per lineal foot. The Fourth district extension includes one storm water overflow and one masonry intake with iron grate. It extends through a culvert, under the Pennsylvania railroad, 219 feet long. It is a double 3x3 foot stone "box culvert"; the bottom of one of the openings is to be made smooth with Portland cement, concrete or brick work, and to be finished smooth with Portland cement mortar, so as to form an invert with one foot radius, and flaring sides at least two feet in hight for the whole length.

CONTRACTS TO BE LET.

Sealed proposals will be received until Nov. 20, at Mobile, Ala., for constructing about 22 miles of sanitary sewers.

Sealed proposals will be received until Oct. 3 at Winton Place, O., for constructing sewers in Winton and Gray roads.

Sealed bids will be received until Oct. 7, at Wausau, Wis., for the construction of a system of sewerage. Certified check $200.

Bids are being advertised at Detroit, Mich., for ten lateral vitrified crock sewers, 12 inches in diameter and 9,662 lineal feet in length.

Sealed bids will be received at Chicago, Ill., until Nov. 20 for constructing the regulating works for the main drainage channel. Certified check $5,000.

Bids will be received until Oct. 7, at Fremont, Ia., for digging a ditch and laying the tile on the south side of Main-st. across blocks 10 and 11, and across the intervening street.

Sealed proposals will be received at Buffalo, N. Y., until Oct. 2, for constructing brick and tile sewers in sundry streets. Certified check and bond 50 per cent.

Bids are invited until Oct. 4, at Ft. Wayne, Ind., for the construction of local sewers in the alleys between St. Mary's-ave. and Oakland-st., and between Winter and Lillie-sts. Certified check $25.

Sealed proposals will be received at Albany, N. Y., until Oct. 7, for constructing a vitrified stoneware pipe sewer, with appurtenances, in Broad-st., from the sewer 100 feet north of Third-ave. to Schuyler-st.

Sealed proposals will be received until Oct. 4, at McKee's Rocks, Pa., for the construction of 1,600 feet of brick sewer, 5 feet in diameter; 3,400 feet brick sewer, 28x44 inches; 3,000 feet 30-inch pipe sewer; 1,800 feet 20-inch pipe sewer. Certified check $1,000.

CONTEMPLATED WORK.

Neenah, Wis., has voted to construct a sewerage system.

Altamont, N. Y., contemplates the construction of a sewerage system.

A petition has been prepared for sewers in Main and Tenth-sts., Darby, Pa.

The citizens of the First ward, Orange, N. J., are anxious for a brick sewer.

Viewers have been appointed at Pittsburg, Pa., for constructing sewers in twenty-one streets.

George K. Reeder of Helena, Mont., has been engaged to prepare plans and specifications for a sewerage system for Billings, Mont.

Ordinances have been passed at Cleveland, O., for the construction of sewers in Russell and Watkins-aves. and Union and Thurman-sts.

Plans have been prepared for the drainage of three new sewer districts at Toledo, O. The districts are Nos. 24 and 25 and Auburndale.

J. Donahue, county surveyor at Ukiah, Cal., took note of the sewerage system in Santa Rosa for use in a proposed drainage system in Ukiah.

The plan of W. A. Kiersted, for sewering Independence, Mo., proposes a main sewer from 15 to 18 inches in diameter to carry away the storm and surface water.

A report has been adopted by the board of public improvements, at St. Louis, Mo., establishing and providing for the construction of Tower Grove storm sewer.

A plan is under consideration by the ordinance committee of the council for improving the entire sewerage system of Bridgeport, Conn. A sewer commission will probably be appointed.

Petitions have been presented to the city council at Camden, N. J., asking for sewers in Henry, Second and St. Johnsts., and for the extension of the sewer on Kaighne-ave., from Louis-st. to Hadden-ave.

An appropriation of $175,000 has been asked for to provide for better sewers in the territory in Westchester county recently annexed to New York City. The condition of the sewers in Williamsbridge and Wakefield is a menace to public health.

The plans of Alexander Potter, city engineer, for the proposed system of sewerage for Far Rockway, N. Y., require 42,000 lineal feet of 5-inch, 9,800 feet of 10-inch, 7,575 feet of 12-inch, 1,130 feet of 15-inch and 800 feet of 18-inch pipe sewers, and 110 manholes and 40 flush tanks. The village would be drained by gravitation, sub-stations established, and pumps put in. The sewerage would be pumped to the disposal grounds, which it is proposed would be located at Inwood.

WATER-WORKS.

CONTEMPLATED WORK.

San Jose, Cal., favors owning and operating its own water and lighting system.

Bonds will be issued at Malden, Mass., for the extension of the water works system.

The following places will vote upon the issue of water works bonds: Wauwatosa, Wis., Oct. 15; Turner, Ill., Oct. 15.

Water works systems are contemplated at the following places: Hiram, O., Princess Anne, Md., Pardeeville, Wis.

Expert opinion is to the effect that Brockton, Mass., must take measures to secure a more adequate water supply within five years.

John McDonald, Brazil, Ind., writes that as rapid progress is not being made with the water works extension as was expected. About 23,760 feet of old and new mains remain to be laid, and 7,920 feet of old mains to be taken up.

The Massachusetts state health board has appropriated a sum of money to determine experimentally the best method of purifying drinking water.

An effort will be made at Mt. Clemens, Mich., to have estimates made and proposals received this fall for a water supply so that work can begin early in the spring.

The residents of Allegany, N. Y., have decided to vote on the question of incorporation, and if it should prove favorable a water works system will probably be established.

Water works bonds have been favorably voted upon at the following places: Tully, N. Y.; Grove City, Minn.; Oxford, Ia.; Forest Grove, Ore.; Belmond, Ia.; Wauseon, O.; Nyack, N. Y.

CONTRACTS TO BE LET.

New bids will be received Oct. 4 at Peotone, Ill., for the construction of a water works system.

Sealed proposals will be opened Oct. 9 at Cleveland, O., for the construction of a temporary crib for the new water works tunnel.

Sealed proposals will be received until Oct. 21 at Washington, D. C., for furnishing and erecting at the U-st. pumping station one 8,000,000-gallon pumping engine, with boilers and appurtenances.

BRIDGES.

A new bridge is proposed over Jones-ave. at Atlanta, Ga.

A hoist bridge will be constructed over the canal at Main-st., Middletown, O.

The Bloomfield-ave. canal bridge, Newark, N. J., will be reconstructed by William Hanna for $1,475.

Sealed proposals will be received at Mansfield, O., for constructing an eighty-foot brick arch over Toby's run.

The county levying court, Little Rock, Ark., will be asked, in October, to make an appropriation for a free bridge.

The petition for a county line bridge over Otter creek, near Muscatine, Ia., has been laid over until January, 1896.

The plans for the bridge over Buffalo bayou at Hill-st., Houston, Tex., have been approved by the secretary of war.

The Clinton bridge and iron works, Clinton, Ia., was awarded the contract for building an iron bridge at Marengo, Ia.

Plans and specifications have been ordered prepared for a bridge over Pleasant run at Meridian-st., Indianapolis, Ind.

Bids are invited at Beatrice, Neb., until Oct. 8 for the construction of five iron bridges in Gage county. Certified check $300 each.

Bids are invited until Oct. 1 at Marinette, Wis., for building nine bridge piers and abutments in the Menominee river at Bridge-st. Certified check $200.

The new plan for the future Chicago river bridges embraces the lift or bascule type. The first bridge built under this plan will be at N. Halstead-st.

The Wrought Iron bridge company, Canton, O., was awarded the contract for a new iron bridge across the Arkansas river at Lamar, Col., for $11,850.

Sealed proposals will be received until Oct. 8 at Cannelton, Ind., for building and constructing an iron bridge and abutments over Sulphur fork of Anderson river at a place known as Ray's ford.

The contract for constructing the paper mill bridge between Marinette, Wis., and Menominee, Mich., was awarded to W. D. Van Norman of Minneapolis for $48,000.

The county commissioners, Zanesville, O., awarded the contracts for the Gaysport and Taylorsville bridges to the King bridge company of Cleveland for about $8,000.

Sealed bids will be received at Brookings, S. D., until Oct. 7 for building a wooden or iron bridge across Six Mile creek; also a wooden or iron bridge over Sioux river.

The Wrought Iron bridge company, Canton, O., was awarded the contract at Albany, Ind., for a bridge over Big Indian creek at Tompkinsford, Greenville township, for $1,950.

The F. C. Austin manufacturing company, Chicago, Ill., was awarded the contract at Rockford, Ill., for constructing a bridge across Keith creek on Eighth-ave. for $1,185.

The contract for building a railroad bridge over the Frazer river at New Westminster, British Columbia, was awarded to the Bullen bridge company at Pueblo, Col., for $400,000.

Sealed bids are invited until Oct. 3 at Stapleton, N. Y., for the construction complete of a masonry, steel and brick highway bridge over Harbor brook on Henderson-ave., Castleton, Richmond county.

A plan is proposed at Nashville, Tenn., to change the grade of Broad-st. and West End-ave., which plan contemplates the building of a bridge by the Nashville, Chattanooga & St. Louis railroad from Walnut-st. nearly to McNairy.

Contracts were awarded for bridges Sept. 3 at Sedalia, Mo., as follows: Across Muddy creek, Wrought Iron bridge company, St. Louis, $4,400; Flat creek, George E. King bridge company, Des Moines, Ia., $1,300; Spring fork, Farnsworth & Blodgett, Kansas City, $1,350.

Luther Dean, city engineer at Taunton, Mass., writes that bids were received Sept. 4 for a girder bridge over Three Mile river at Winthrop-st. The lowest bid, $4,225, was presented by R. F. Hawkins iron works. G. A. Dailey & Son, Providence, R. I., secured the contract for the stone work.

The site of the bridge that is to span the Ohio river at Rochester, Pa., will be located almost at the foot of New York-st. at Rochester and about 300 feet above the ferry landing in Monaca. The bridge will be of the suspension type, with a 700-foot channel span. The building of the bridge is delayed by the lack of capitalists to invest in the enterprise.

A special committee has been appointed at Ottumwa, Ia., to correspond with different bridge manufacturers to find out if the city can build two new bridges in the near future by applying a certain per cent. of annual levies each year. A

special bridge committee, consisting of Aldermen Baker, Crawford and Asbury, was also appointed to further consider the plans for the erection of additional bridges, if possible, under the existing financial condition of the city.

The plans, with estimates of costs, have been submitted to the board of county commissioners at Topeka, Kas., for a new bridge across the Kansas river at Kansas-ave. Mr. Thacher of Keepers, Wynkoop & Thacher, Detroit, Mich., submitted a plan which is substantially a stone arch bridge composed of steel girders, concrete filling and stone facing. It is 700 feet in length, 40 feet in width, a roadway of 26 feet and two sidewalks of 7 feet; consists of seven spans, one 126 feet, two 100 feet, two 79 feet and two of 58 feet each. Mr. Hinckley, consulting engineer, submitted a plan with a roadway 24 feet wide, two sidewalks of 6 feet, steel girders of 100 feet, span resting on steel cylinders.

STREET CLEANING.

Detroit, Mich., contemplates cleaning the asphalt by flushing. A test will be given the plan.

Commissioner George A. Waring, New York City, has asked for an appropriation of $3,187,052 for cleaning the streets next year, $991,052 more than was appropriated last year.

The asphalt pavements on Sixth and Seventh-sts., St. Paul, Minn., will be swept by hand six days per week at the expense of the city, and if it is found necessary to flush them they will be flushed every night.

Bids have been submitted to the board of public works, Indianapolis, Ind., for the street cleaning contracts for next year. Fuehring Bros. submitted the lowest bid in three districts, and the Indianapolis street cleaning company, which operates the Furnas sweeper, submitted the lowest bid for the other district. It is probable that the lowest bidder will be awarded the contracts in each instance.

PARKS.

A park will be established at West Oakland, Cal.

A public park has been proposed for Ft. Myers, Fla.

A public park is proposed for West Utica, N. Y.

The park board at Minneapolis, Minn., decided Sept. 16 to ask for $134,000 for next year.

The West Side of Joliet, Ill., will vote on the proposition of organizing into a park district.

Plans have been completed for the new Lehigh park, lying between Allentown and Rittersville, Pa.

The park commissioners at Taunton, Mass., has recommended the purchase of 1,850 feet of land.

Land has been donated to the city of Liberty, Mo., for a public park by Mrs. Hurt of Kansas City, and John K. Lincoln of Plattsburg.

The residents of Black Rock and Buffalo, N. Y., are agitating the establishment of a public park in the neighborhood of Tonawanda-st.

A resolution was presented to the council at Pittsburg, Pa., Sept. 9, for an appropriation of $7,000 to establish a park along Bluff-st.

Riverside, Cal., which contemplates the establishment of a handsome park, has received an offer of a gift of a portion of the park site from S. C. Evans, Sr.

The extension of the Harrisburg line to Lake Olmstead, and the purchase of the Lake View property by the Augusta railway company means a new park for Augusta, Ga.

The common council at Oil City, Pa., has accepted the donation of about forty acres of land and a cash donation of nearly $3,000 to improve the same for park purposes.

The common council at Yonkers, N. Y., has directed the city attorney to prepare an act to be submitted to the next legislature empowering the city to purchase land for public parks.

A magnificent system of parks is projected for Essex county, N. J., which will not only give breathing space to the crowded population of Newark, but will preserve the natural beauties of the Oranges.

A plan has been suggested at Atchison, Kas., for improving the city park. Name it for some old and respected citizen who will improve it; then, when the park is in fine condition let a park tax be collected annually from every lot to maintain it.

The report of the committee on small parks at Philadelphia, Pa., will recommend that all of the unimproved squares in the built-up section shall be used as children's playgrounds and that the grading and planting of trees shall be done immediately.

J. H. Steele of Chicago has agreed to give ten acres of land in Waukegan, Ill., for park purposes if the owners of the adjacent property will give for a like purpose. Mr. Steele wants Waukegan to take advantage of the recently enacted law which empowers towns and cities to levy taxes, on petition and the vote of the people, for park purposes.

MUNICIPAL BONDS.

Goshen, Ind., will issue $15,000 worth of water works bonds.

Bids are invited until Oct. 7 at Carthage, O., for $3,597.83 6 per cent. bonds.

Bids are asked until Oct. 10 at Oxford, O., for $25,000 4½ per cent. water works bonds.

Sealed proposals will be received at Van Wert, O., until Oct. 7 for $10,430, 5 per cent. street improvement bonds.

Rollins & Co. of Boston, Mass., were the successful bidders Sept. 10 at Altoona, Pa., for $280,000 of sewer bonds at a premium of $3,250.

Bids will be received until Oct. 4 at Norwood, O., for $30,000 electric light bonds. Also $25,000 5 per cent. bonds. W. E. Wichgar, Clk. 317 Main-st., Cincinnati, O.

Durability of Trinidad Lake Asphalt Pavements.

IT is generally conceded that asphalt pavements have more points of excellence than any other kind. The main question now is, how long will they wear? Experience has demonstrated that they are durable.

The pavements of this kind which have been longest in use are those made of Trinidad Lake Asphalt, and this is the material which experience has shown to be the best Pavements made of Trinidad Lake Asphalt have been in use over seventeen years, and are still in good condition. Contractors who use Trinidad Lake Asphalt will guarantee such pavements to last fifteen years or longer.

An instance of the superior wearing qualities of Trinidad Lake Asphalt pavements may be cited in Cincinnati, where the American Society of Municipal Improvements has just held its meeting. Race street, in that city, was paved with Trinidad Lake Asphalt in 1886, and at the same time the car tracks at the intersection of Fifth and Race, were paved with granite blocks. This granite pavement was practically worn out after six years of service, and, by direction of the City Engineer, was taken up and renewed.

FIGURE 1.

Figure 1 (from photograph) shows how the old granite blocks looked when taken up, as compared with the original standard block. According to the City Engineer's census of travel, this pavement was subjected to 318 tons of travel per square foot per day, or a total of 696,420 tons during its life of six years.

Figure 2 (also from photograph) shows a block cut from the center of Race street between Sixth and Seventh streets. This pavement carried 204 tons of travel per square foot per day, or 260,210 tons up to the time this block was cut out—after nearly seven years. The asphalt had lost no appreciable part of its thickness at that time and was still in first-class condition.

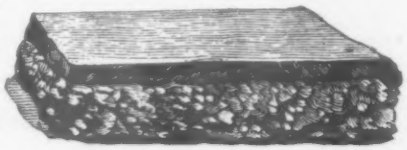


FIGURE 2.

Municipal officers who want the best material and are unwilling to risk experiments at the public expense insist on the use of Trinidad Lake Asphalt. It is THE STANDARD ASPHALT. When it is used the municipal officer who is responsible for the work and the property-owner who pays for it, both know that they are getting the best; they are not troubled with fears and doubts; they do not feel that they are making a risky experiment. Experience through the longest period of time *proves that Trinidad Lake Asphalt is the best*; the foremost authorities declare it to be the best.